Chapter 3

Affected Environment, Impacts, and Mitigation Measures

3.0.1 Introduction

This chapter describes the existing conditions (Affected Environment) that would be affected by the proposed Facility and analyzes the potential environmental impacts that could occur if the proposed Facility were to be built, operated, and maintained over a 20-year lifespan, and eventually decommissioned at the end of that lifespan. This chapter also describes the potential environmental impacts associated with the transportation of crude oil from North Dakota to the proposed Facility by unit train, and from the proposed Facility to receiving refineries by marine vessels.

3.0.2 Environmental Resources

The following environmental resources are analyzed in this Draft Environmental Impact Statement (EIS)[1]:

- Earth Resources (including seismic hazards)
- Air Quality
- Water Resources
- Terrestrial Vegetation
- Terrestrial Wildlife
- Aquatic Species
- Energy and Natural Resources
- Environmental Health
- Historic and Cultural Resources
- Transportation
- Public Services and Utilities
- Noise
- Land and Shoreline Use
- Visual Resources
- Recreation

The Washington Energy Facility Site Evaluation Council (EFSEC) has included analysis of the following issues in the Draft EIS to address specific concerns raised by members of the public, government agencies, tribal representatives, and other interested stakeholders during the Washington State Environmental Policy Act (SEPA) scoping process:

- Rail transportation impacts near the proposed Facility site, specifically including Vancouver and nearby communities
- Greenhouse gases (GHGs) and other air emissions from proposed Project operations
- Proposed Facility site emergency response capabilities, including hazmat response to incidents involving crude oil transported by railcar
- Proposed Project impacts to socioeconomic resources including employment, tax revenue, and economic conditions

1 See http://www.efsec.wa.gov/Tesoro%20Savage/20140403FinalSepaScope.pdf

- Rail transportation impacts to communities in Washington
- Emergency response capabilities including hazmat response to incidents involving crude oil transported along the rail route within Washington
- GHGs/other air emissions from rail and vessel traffic within Washington
- Emergency response capabilities along cargo ship traffic lines on the Columbia River, from the proposed Facility site to the confluence with the Pacific Ocean
- Cargo ship impacts from the proposed Facility site to the confluence with the Pacific Ocean
- Qualitative analysis of rail transportation data along the rail route beyond the state boundary
- Qualitative analysis of cargo ship transportation data beyond the state boundary
- Qualitative analysis of proposed Project data related to crude oil extraction, refining, and burning of fossil fuels, and their contribution to GHG emissions

3.0.3 Environmental Impacts

Two primary types of environmental impacts are described in this chapter: direct impacts and indirect impacts. *Direct impacts* are the effects of an action (i.e., construction, operation and maintenance, or decommissioning) on a resource that occur at the same time and place as the action. *Indirect impacts* are similar to direct impacts in that they are caused by the same action; however, they occur later in time or are farther removed in distance from the activity causing the impact. An example of a direct impact would be increased noise levels experienced by residents living near a construction site. An example of an indirect impact would be a decline in numbers of a wildlife species due to fragmentation of that species' habitat by construction of a new highway.

The direct and indirect impacts associated with the proposed Facility and rail and marine vessel operations have been described quantitatively in this Draft EIS if sufficient data or information were available to do so. When detailed information was not available, impacts have been described qualitatively. For example, information pertaining to the rail corridor in Washington was more readily available than similar information for the portions of the rail corridor in Idaho, Montana, and North Dakota. Therefore, impacts associated with the rail corridor outside of Washington are described qualitatively rather than quantitatively.

A third type of environmental impact is referred to as a *cumulative impact*. This term is used to describe effects on the environment that result from the incremental impacts of an action (both direct and indirect) when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. An example of a cumulative impact would be a measurable increase in the mortality of juvenile salmon stranded on the shoreline of the Columbia River due to the combined effects of large wakes generated by an increased number of deep-draft vessels transiting the river. The discussion of cumulative impacts that could occur from the proposed Facility in combination with other past, present, or reasonably foreseeable future projects is presented in Chapter 5.

This Draft EIS uses the following four-level rating method to describe the magnitude, duration, and degree of potential environmental impacts (see Figure 3.0-1):

- **Negligible.** Impacts that are extremely low in intensity and often not measurable or observed
- **Minor.** Impacts that are low in intensity, temporary, and local in extent, and do not affect unique/rare resources

- **Moderate.** Impacts of moderate intensity independent of duration, with significant or unique resources potentially affected, on either a local or regional scale
- **Major.** Impacts of high intensity and/or of long-term or permanent duration, of localized or regional extent, and/or that affect culturally important, ecologically important, or unique/rare resources

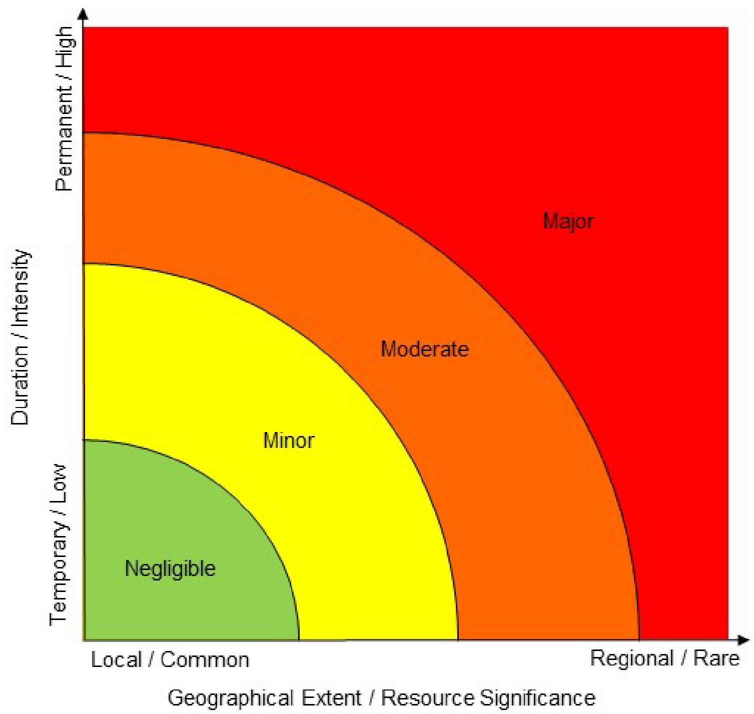

Figure 3.0-1. Schematic of Environmental Impact Ratings

Each resource section in Chapter 3 includes a discussion of potential impacts associated with the No Action Alternative (described in Chapter 2); describes mitigation measures that can be implemented to avoid, reduce, or compensate for anticipated impacts; and identifies significant unavoidable adverse impacts that cannot be mitigated. In this context the term *significant* means "a reasonable likelihood of more than a moderate adverse impact on environmental quality" (Washington Administrative Code [WAC] 197-11-794). In this Draft EIS, *significant unavoidable impacts* are those impacts that remain "moderate" or "major" in magnitude, duration, or degree, even after all mitigation measures committed to by the Applicant or recommended by EFSEC have been applied (see the following section for more on mitigation measures).

It should be noted that Chapter 3 analyzes impacts to the environment that could occur during normal operations at the proposed Facility and during normal operations of transporting crude oil to and from the proposed Facility. During normal operations minor leaks and drips of crude oil could occur at the proposed Facility site or along the rail and vessel transportation corridors. These small-scale releases are acknowledged in the analysis in Chapter 3 and are assumed to be easily contained and rectified by following normal maintenance procedures. Federal regulations to prevent leaks and drips from railcars carrying crude oil include the requirement for the design of all tank car valves applied to be approved by the Association of American Railroads Tank Car Committee (Federal Railway Administration [FRA] 2015).

The potential impacts from the release of crude oil at the proposed Facility or during the transportation of crude oil to and from the proposed Facility in volumes greater than minor leaks and drips, including the potential for fire and explosion, are addressed in Chapter 4. Chapter 4 includes an analysis of the potential consequences of a crude oil spill, explosion, or fire at the proposed Facility and during associated train and vessel transportation for the same environmental resources addressed in Chapter 3. The potential impacts to fire, police, and emergency response services associated with normal proposed Facility, rail, and vessel operations are described in Chapter 3.

The GHG emissions associated with the extraction, refining, and end use of crude oil that moves through the proposed Facility and the contribution of those activities to GHG emissions are discussed in Chapter 5. The contribution of those GHG emissions to impacts associated with local climate change is discussed in Section 3.2.4.5.

3.0.4 Mitigation Measures

Each environmental resource section in Chapter 3 includes a discussion of *mitigation measures* that can be implemented to reduce impacts associated with the construction, operation and maintenance, and decommissioning of the proposed Facility, as well as potential impacts associated with the transportation of crude oil to and from the proposed Facility. According to SEPA (WAC 197-11-768), mitigation means:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology or by taking affirmative steps to avoid or reduce impacts;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
- Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or
- Monitoring the impact and taking appropriate corrective measures.

Such measures may be proposed by the Applicant, required by applicable law, or imposed by the governor or EFSEC pursuant to their authority under Revised Code of Washington (RCW) 80.50 or through the use of their SEPA “substantive authority,” which provides the ability to condition or deny a proposal based on environmental impacts (WAC 197-11-660).

Various design features and best management practices (BMPs) proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts in this Draft EIS. Additional measures identified by EFSEC to minimize remaining impacts are presented as mitigation measures for each environmental resource in Chapter 3 for consideration by decision makers.

3.0.5 Study Area for Proposed Facility

The study area for assessing environmental impacts for the proposed Facility in Chapter 3 includes all areas within the proposed Facility footprint at the Port of Vancouver (Port) where ground disturbance or construction activity associated with the rail infrastructure, unloading facility, storage area, marine terminal, transfer pipelines, or boiler building would occur. At the marine terminal the study area includes areas near Berths 13 and 14 where vessels would maneuver during docking and departure operations and be moored during vessel loading (Figure 2-1). For some resource topics, the study area was expanded to include surrounding areas where impacts associated with the proposed Facility would be observable or perceptible beyond the proposed Facility footprint or outside the vessel maneuvering area at the marine terminal. These expanded areas are described in each resource section in Chapter 3.

3.0.6 Study Area for Rail Transportation

The study area for assessing environmental impacts associated with rail transportation includes a 1-mile-wide corridor centered on the existing Burlington Northern Santa Fe (BNSF) rail line extending approximately 1,187 miles from Williston, North Dakota, to the Port. Within Washington, this rail route is referred to as the Columbia River Alignment and is shown on Figure 3.0-2. For the purposes of impact analysis in this Draft EIS, it is assumed that loaded unit trains originating near Williston, North Dakota, would transport crude oil to the proposed Facility following the Columbia River Alignment. Although the precise routing of individual unit trains would be determined by BNSF depending on the location of the unit train loading facility and track usage and condition at the time of delivery, this rail transportation route is considered by EFSEC to be an appropriate representative rail delivery route for the purposes of environmental analysis in this Draft EIS because it is the most direct route between likely crude oil loading facilities in North Dakota and the Port.[2]

A possible return route for empty unit trains traveling back to Williston on existing BNSF rail lines has also been identified. The return route, referred to as the Central Return - Stampede Pass Alignment, runs north from Vancouver to Auburn and then east over the Cascade Range to Pasco, where it connects to the same BNSF rail line used by delivery trains traveling between the Washington-Idaho border and Pasco (Figure 3.0-2). The Central Return - Stampede Pass return route is analyzed in this Draft EIS for potential impacts to air quality, terrestrial wildlife, and transportation to address specific concerns identified during scoping. The Central Return - Stampede Pass return route is not addressed for other resource topics because the four empty trains departing the proposed Facility and returning to Williston each day would not result in impacts distinguishable from those associated with existing freight train traffic currently using the route. Central Return - Stampede Pass return route is consistent with BNSF's directional running agreement introduced in 2012 to use Stampede Pass for eastbound empty bulk trains (Ecology 2015).

2 Alternative westbound rail routes in Washington go over the Cascade Mountains and the steep inclines are prohibitive to heavy loaded trains.

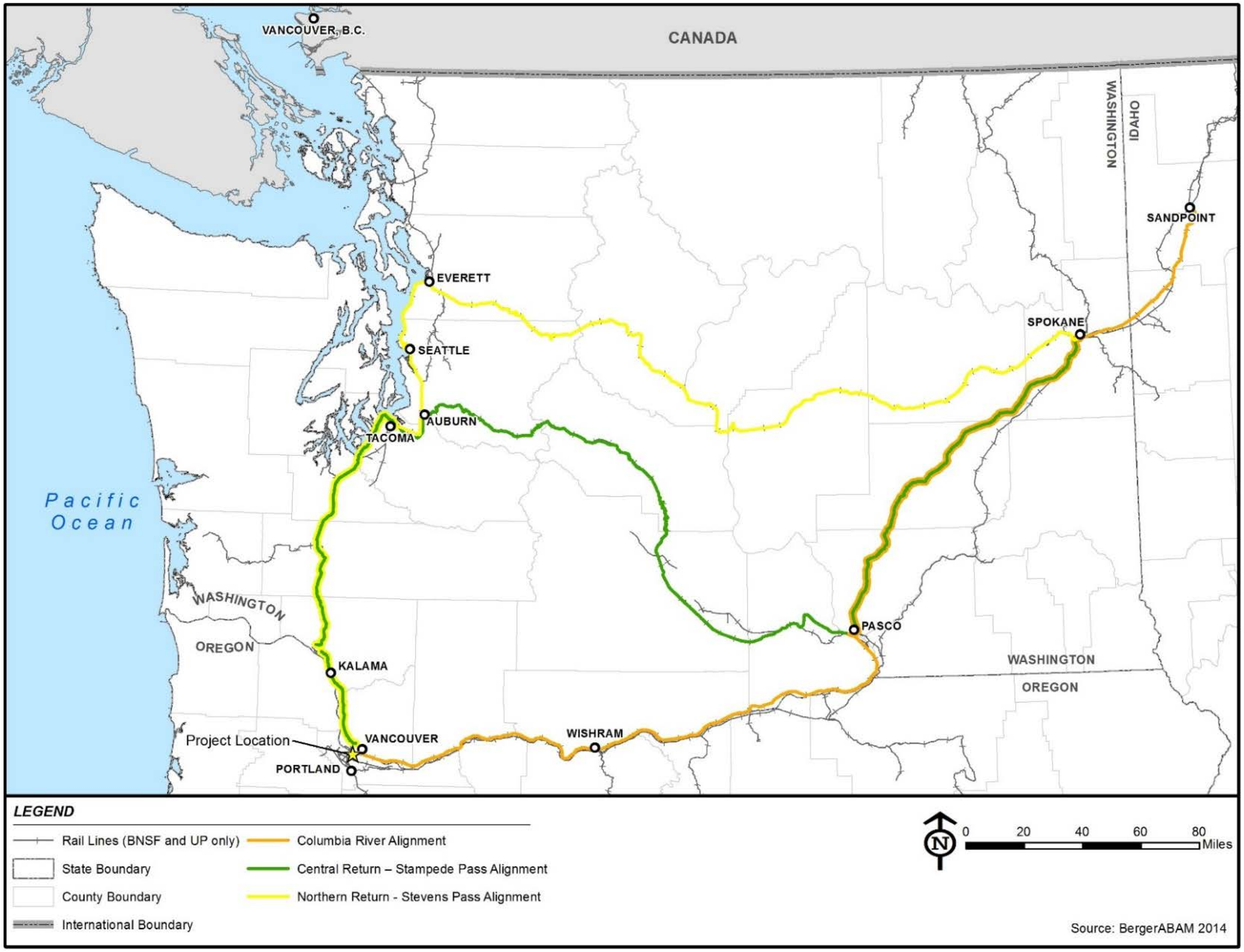

Figure 3.0-2. Rail Alignments in Washington and Neighboring Areas of Idaho and Oregon

3.0.7 Study Area for Vessel Transportation

The study area for vessel transportation includes a corridor extending 106 river miles along the Columbia River from the marine terminal at the proposed Facility to the Pacific Ocean, including an area extending 3 nautical miles (nmi) out to sea from the river's mouth. The 3-nmi distance from the mouth of the Columbia River was selected for the western boundary of the study area for vessel transportation because it is consistent with the seaward limit of Washington's coastal zone boundary (Ecology 2001). The study area includes the river itself and land on both sides of the river extending 0.25 mile inland along the corridor from the marine terminal to the Pacific Ocean. For those environmental resources for which potential impacts could arise beyond this boundary, including water resources, aquatic species, environmental health, noise, visual resources, recreation, cultural resources, and transportation, information is presented for vessel operations beyond 3 nmi from the mouth of the Columbia River.

3.0.8 Study Areas for a Potential Crude Oil Spill, Fire and/or Explosion

The study areas described above and affected environment descriptions provided in Chapter 3 for the proposed Facility and rail and vessel transportation corridors were also used for the resource specific potential impact discussions in the event of a crude oil spill, fire and/or explosion (Section 4.6). Since the inbound rail line from Kennewick/Pasco to the Port runs in close proximity to the river, an additional study area was created to assess the potential impacts of a crude oil spill that reached the Columbia River from a unit train derailment. This study area is termed the rail-Columbia River study area and includes approximately 216 river miles and extends 0.25 mile inland to the north and south banks of the Columbia River (Figures 3.0-3 and 3.0-4). The additional study area was established to consider potential impacts to resources present within the Columbia River and its shorelines but outside the bounds of the rail transportation study area.

3.0.9 Use of Applicant-Prepared/Provided Information

A variety of documents and information sources provided by the Applicant were used to prepare this Draft EIS, including an Applicant-prepared Preliminary Draft EIS, Applicant responses to formal EFSEC data requests, a variety of reports and technical documents prepared by the Applicant's consultants, and preliminary engineering plans. EFSEC's independent consultant reviewed all Applicant-prepared information and analyses provided before including them in this Draft EIS. The information provided by the Applicant was extensively supplemented with additional information and analyses prepared by EFSEC's independent consultant to provide decision makers with sufficient information to make a reasoned choice among alternatives.

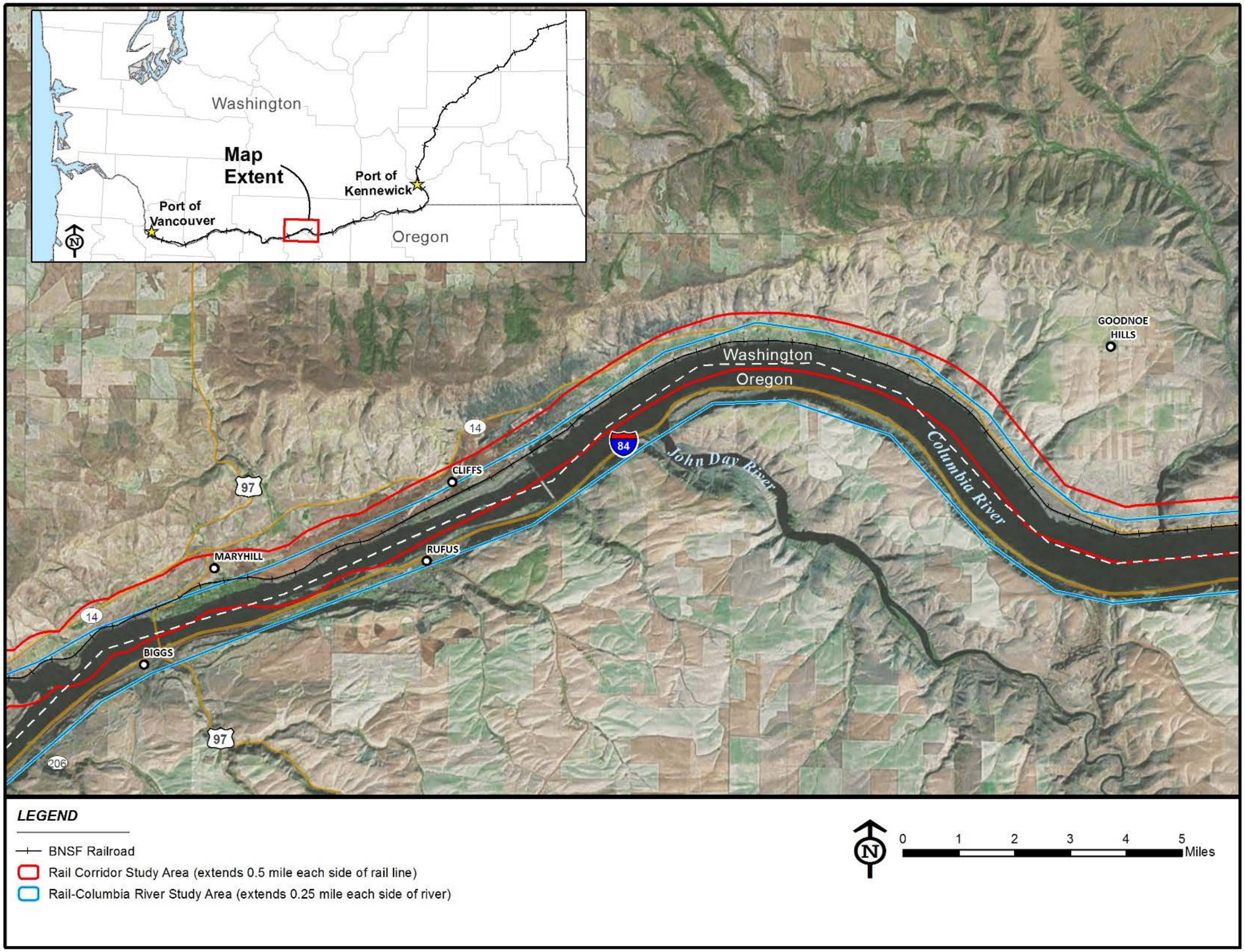

Figure 3.0-3. Rail-Columbia River Study Area – Close-up View of Partial Area

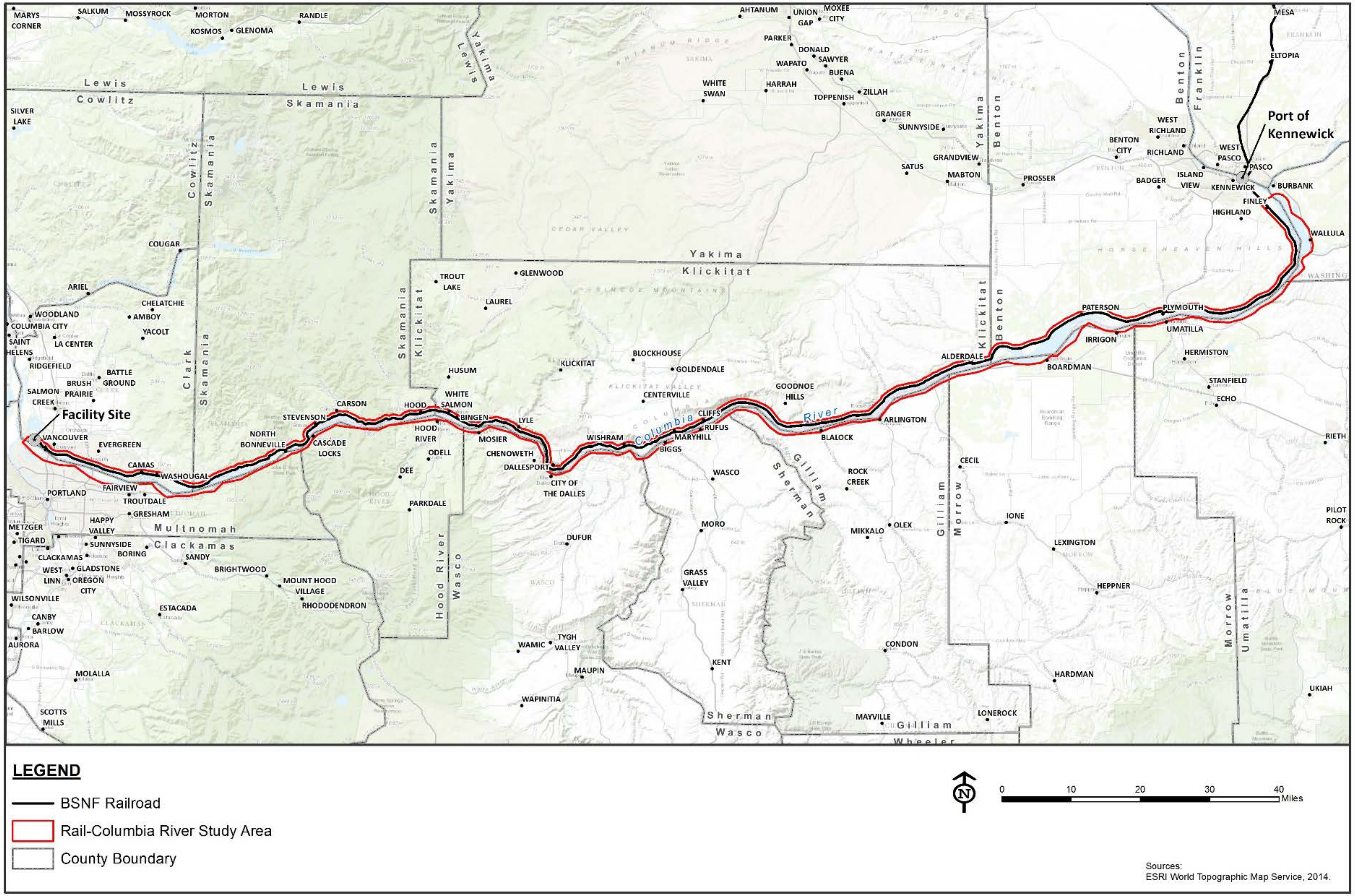

Figure 3.0-4. Rail-Columbia River Study Area – Entire Study Area

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3.1 EARTH RESOURCES

This section describes the earth resources present within and in close proximity to the proposed Facility site and along the rail and vessel transportation corridors. The nature, magnitude, duration, and intensity of impacts to earth resources resulting from construction, operations and maintenance, and decommissioning of the proposed Facility and impacts to earth resources along rail and vessel corridors are presented. Earth resources addressed in the analysis include bedrock, soils, and topography. Geologic hazards that could impact the proposed Facility and operations along the rail and vessel corridors are also addressed. Mitigation measures to reduce impacts to earth resources and threats from geologic hazards are presented.

3.1.1 Methods of Analysis

The study areas for earth resources are generally consistent with those described in Section 3.0. However, the source of important geologic hazards that could affect the proposed Facility and operations along the rail and vessel corridors is well outside the study area and is addressed in this section.

Potential impacts to earth resources have been assessed by reviewing site geologic and geotechnical data collected by the Applicant and the Port or its tenants and other relevant data and reports available in the public record. The analysis of impacts to earth resources considered impacts from proposed Facility construction and operation including soil erosion, soil disturbance, and alterations to topography. Potential impacts from geologic hazards such as earthquakes, landslides, and volcanic eruptions were also considered for the vicinity of the proposed Facility, the rail corridor, and the vessel corridor.

The Applicant conducted an initial assessment of earth resource impacts resulting from construction, operations and maintenance, and decommissioning of the proposed Facility, and an assessment of the potential for impacts to the proposed Facility resulting from either earthquake-induced ground shaking or from the effects of an earthquake-induced tsunami. The Applicant's geotechnical site assessment was based on existing information in the public record addressing geologic resources within the affected environment, supplemented by geotechnical information from onsite studies the Applicant's consultant conducted. The onsite work included soil sampling from 25 borings, soil analysis from six cone penetrometer tests (CPT), and soil strength analysis from standard penetration tests (SPT). The CPT determines the strength of the soil by measuring the resistance as an instrumented steel cone is driven into the subsurface, and the SPT measures soil strength by determining the number of blows required by a 140-pound hammer to penetrate 30 inches into the soil. The borings and CPTs ranged in depth from 21.5 and 104.2 feet below ground surface [bgs] (GRI 2013). The Applicant's assessment of geologic hazards at the proposed Facility site used this site-specific soils information supplemented by scientific information related to geologic hazards (e.g., earthquake ground motions) (GRI 2013).

Given the importance of fully assessing risks associated with earthquake-induced ground motion, EFSEC commissioned an independent review of potential seismic hazards that could affect the proposed Facility and operations along the rail and vessel corridors and an assessment of the design of the proposed Facility, including ground improvements committed to by the Applicant to address seismically induced soil liquefaction (Appendix C). EFSEC's consultants also reviewed existing information in the public record to assess geologic hazards along the rail and vessel corridors. The following major sources of data were used in the earth resources impact analyses:

- United States Geological Survey (USGS) geologic maps and reports
- Washington State Department of Natural Resources (WDNR) maps and reports
- Oregon Department of Geology and Mineral Industries (DOGAMI) geohazard maps

- Natural Resource Conservation Service (1972) soil survey
- Professional (peer-reviewed) published literature
- Geotechnical Assessment by GRI (ASC Supplement Appendix L)
- Seismic Analysis by AECOM (Appendix C)
- Geologic Engineering Reports by Hayward Baker, Inc. (2014)
- BergerABAM Preliminary Draft EIS (2015)
- BergerABAM Application for Site Certification and Supplements (2014)
- USGS regional seismicity maps
- USGS hazards analysis website
- City of Portland Hazard Maps website
- City of Vancouver Critical Areas/Geologic Hazard Areas website
- Cascades Volcano Observatory (2015) data/maps
- USGS Landslides Program (2015a)
- Washington Division of Geology and Earth Resources reports
- Pacific Tsunami Warning Center (2015)

3.1.2 Affected Environment

3.1.2.1 Proposed Facility

The Port has been an industrial site since 1912 and the natural geologic environment has been modified over the years. Geologic sediments and surface soils have mostly been mixed with or covered by artificial fill. The site's topography has been modified over the years, and the current landscape is mostly flat. Unique physical features that may have existed at some point in the past are no longer present.

Geology

The geologic environment in western Washington is largely a result of the convergent boundary between the North American and Juan de Fuca tectonic plates. The crust beneath the Pacific Ocean that comprises the Juan de Fuca plate is slowly sinking (subducting) beneath the North American continent at a rate of just over an inch per year, forming the Cascadia Subduction Zone (CSZ). This zone of active compression has generated northwest-trending fault zones and is responsible for earthquakes throughout the Pacific Northwest. Crustal blocks that shift along fault zones result in areas of uplifted mountainous terrain and depressed structural basins (Orr and Orr 1996). The subduction also leads to the generation of magma (molten rock) at depth, which rises to the surface to form the active volcanic chain of the Cascade Range.

The Port lies along the northern shores of the Columbia River within the down-dropped Portland Basin (Figure 3.1-1). This structural basin is elongated to the northwest and is bordered by the foothills of the Cascade Mountains to the east, the Tualatin Mountains to the west, the Clackamas River to the south, and the Lewis River to the north (Evarts et al. 2009). The Portland Basin began to form about 20 million years ago with folding and uplift of the Tertiary basement rocks and has, subsequently, been filled with volcanic and sedimentary deposits.[1] Approximately 16 million years ago, basaltic lavas of the Columbia River Basalt Group flowed from now extinct volcanic vents across the Pacific Northwest and into the Portland Basin, eventually covering some 63,000 square miles with basaltic rock,[2] with thicknesses of up to 6,000 feet. These dark gray to black, dense basalts now lie beneath younger sedimentary deposits throughout the Portland Basin.

Over the last 15 million years, riverine and lacustrine (lake) sediments, glacial flood deposits, and volcanic ash and lava from the Cascade volcanoes have been deposited in the Portland Basin (Swanson et al. 1993). The Columbia River deposited nearly 600 feet of poorly cemented siltstone, sandstone, and claystone, known as the Sandy River Mudstone, into the subsiding Portland Basin (Trimble 1963). Overlying the mudstone is the Troutdale Formation, layers of cemented sandstone and conglomerate laid down by a high-energy braided river system, with a thickness of up to 600 feet (Evarts et al. 2009, Tolan and Beeson 1984). The Troutdale Formation sediments were eroded during the last ice age by the ancestral Columbia and Willamette rivers, and by glacial outburst floods that originated from glacial Lake Missoula in what is now Montana (Allen et al. 2009). These glacial floodwaters surged westward across Idaho and Washington and through the Columbia River Gorge to depths of over 400 feet, depositing boulders, cobbles, gravel, and thick blankets of sand and silt throughout the Portland Basin. The flood deposits include layers of silts and coarse sands and layers of pebble to boulder gravel with a coarse sand to silt matrix (Phillips 1987).

As glaciers receded between 15,000 and 10,000 years ago, global sea level rose by approximately 300 feet, forming an estuarine environment that extended far upstream into the Columbia River. This low-energy environment rapidly filled with Holocene (modern) sandy alluvium (river sediment) and broad floodplains developed along the primary Columbia River channel (Peterson et al. 2011). These young river sediments cover all older geologic units at the proposed Facility site; no bedrock outcrops[3] occur at the Port.

Soils

Different soils have different strengths during both static (normal foundation loading) and dynamic (earthquake loading) conditions. Native soils at the Port are post-Missoula Flood alluvium.[4] This natural soil cover has been modified over more than a century of industrial activity at the proposed Facility site and surrounding areas. Native soils on the surface have been mixed with or covered by artificial fill sediments and then graded for industrial purposes. Much of the fill material consists of dredged Columbia River channel sands and silts. Saturated fine- to medium-grained granular soils (silts and fine sands) can lose strength through liquefaction. A liquefied soil behaves more like a liquid than a solid, and as a result loses its structural integrity. Buildings or other structures founded on these soils can be severely damaged as a result of liquefaction. Saturated larger-grained sands and gravels are much less susceptible to liquefaction.

1 Sedimentary deposits are mineral deposits formed during the accumulation of sediment on the bottom of rivers and other waterbodies.

2 Basalt is a dark-colored, fine-grained, igneous rock that most commonly forms as an extrusive rock, such as a lava flow, but can also form in small intrusive bodies, such as an igneous dike or a thin sill.

3 A visible exposure of solid rock.

4 Deposits of gravel, sand, silt, and clay from dozens of floods from Glacial Lake Missoula that occurred between 15,000 and 12,700 years ago.

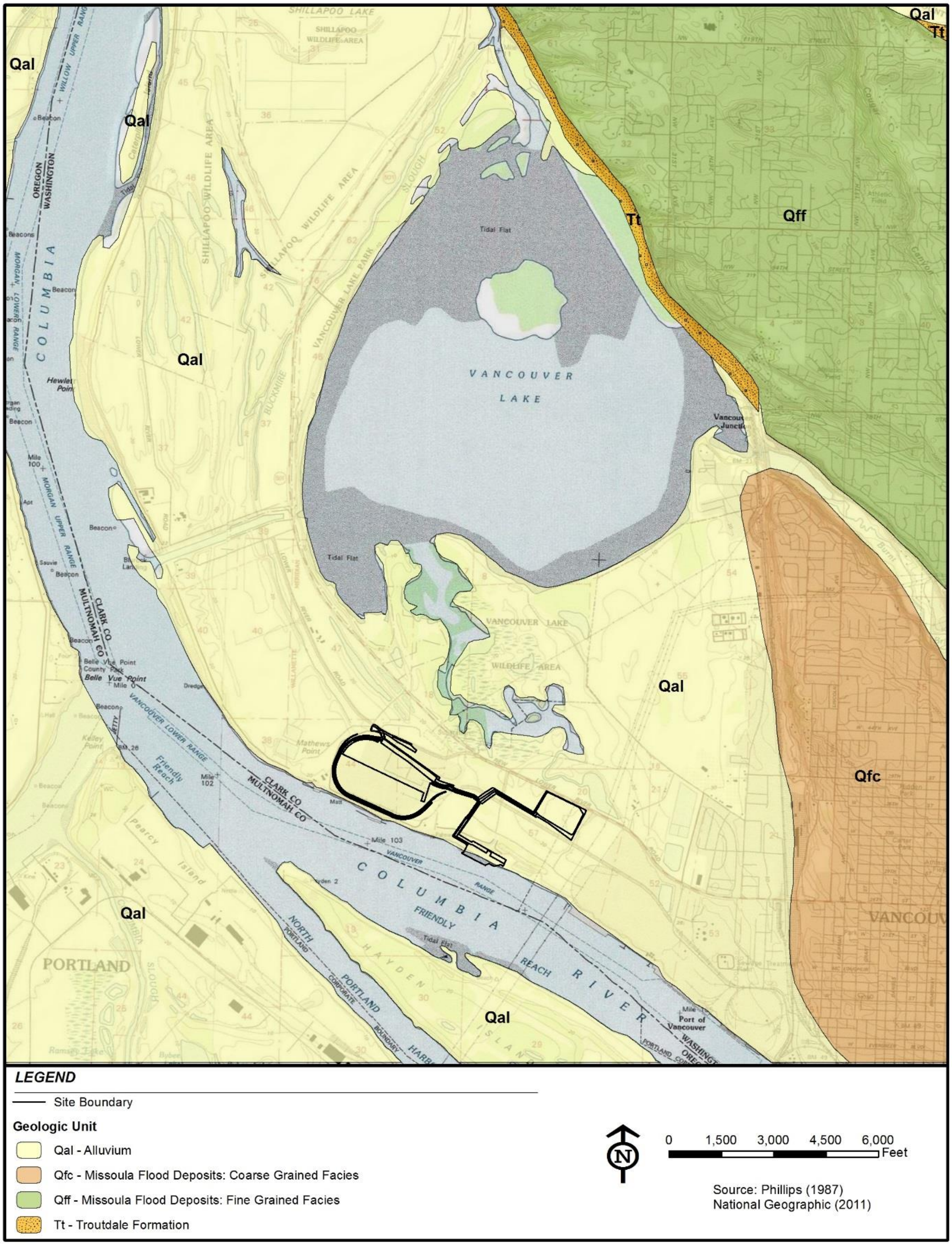


Figure 3.1-1. Site Geology

The Applicant's consultants have conducted two geotechnical field investigations at the site, utilizing borings and cone penetrometer probes to determine the soil and sediment composition (GRI 2013, Hayward Baker 2014). The soil profiles encountered include up to 25 feet of primarily granular fill, underlain in most borings by up to 17 feet of very soft to stiff silt, followed by typically loose to medium dense alluvial sand to depths ranging from 40 to 64 feet, and underlain by medium dense to very dense gravel of the Troutdale Formation. Soil types found in the vicinity of the proposed Facility site are shown on Figure 3.1-2, and are summarized here:

- **Fill Land (Fn).** These materials consist of artificial fill derived from Columbia River dredge spoil or debris that has been deposited and graded during previous or ongoing site development.
- **Newberg Silt Loam, 0 to 3 percent slopes (NbA).** This soil occurs mainly along the Columbia River. It is loamy soil that developed mainly in recent alluvium derived from basic igneous parent material. This soil is well drained and easily tilled. Permeability is moderately rapid. Surface runoff is very slow, and erosion potential is very low.
- **Newberg Silt Loam, 3 to 8 percent slopes (NbB).** This soil is found on side slopes of natural levees on bottom lands along the Columbia River. The slopes are short and slightly convex or undulating. The soil is similar to Newberg silt loam except that surface runoff is slow, and the erosion potential is slight.
- **Pilchuck fine sand, 0 to 8 percent slopes (PhB).** This soil is found on terraces along streams. It is subject to overflow and deposition during periods when the water level is high. This sandy soil formed in parent material of recent sandy alluvium deposited by streams. The slopes are generally undulating and in most places are less than 5 percent. This soil is excessively drained and rapidly permeable. Surface runoff is very slow. The erosion potential is slight except during flooding, at which time the erosion potential is high.
- **Sauvie silty clay loam, 0 to 8 percent slopes (SpB).** This soil is found on the broad tops of old natural levees on the bottom lands along the Columbia River. In most places, the slopes are smooth or gently undulating. This soil is poorly drained and has moderately slow permeability. Surface runoff is slow. Erosion potential is slight, except in areas subject to flooding from the Columbia River, where scouring can lead to severe erosion. A high water table is common in winter and spring.
- **Sauvie silt loam, 0 to 3 percent slopes (SmA).** This soil is found on the broad tops of old natural levees on bottom lands along the Columbia River and in many of the depressional areas. The soil is moderately well drained, and the profile has fewer mottles. Surface runoff is very slow, and erosion potential is slight.
- **Sauvie silt loam, 3 to 8 percent slopes (SmB).** This soil is found on the side slopes of the old natural levees on bottom lands along the Columbia River. Surface runoff is slow, and erosion potential is slight.
- **Troutdale Gravels.** These medium dense to very dense gravels are found at varied depth beneath overlying alluvium throughout the Port area. (Troutdale gravels do not appear on Figure 3.1-2 with surface soils because they are present only at depth.)

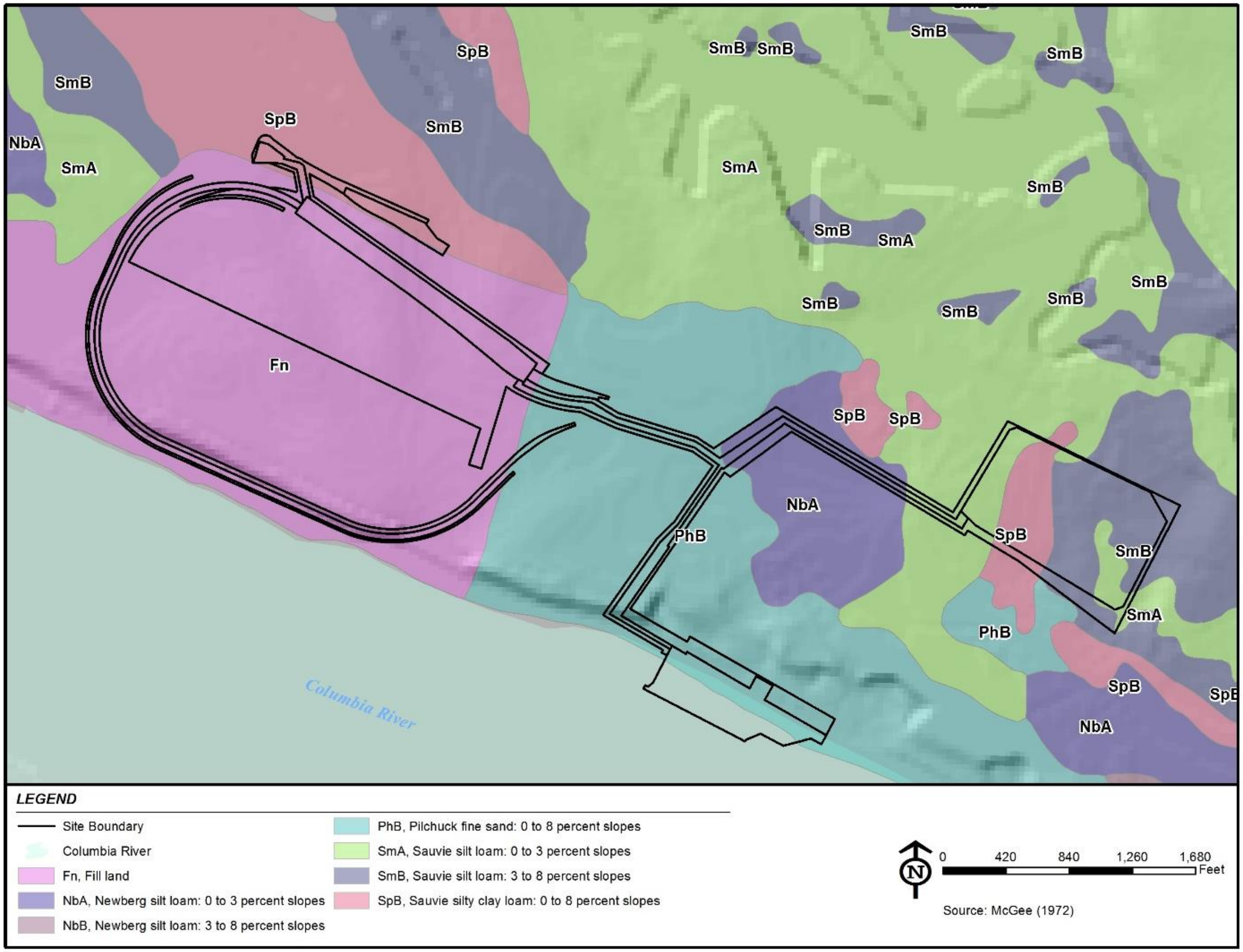


Figure 3.1-2. Soil Types within the Proposed Facility Vicinity

Previous geotechnical investigations on subsurface conditions at other locations within the Port reveal similar soil horizons, with generally softer/looser silts and sands overlying more dense sands and gravels. Investigations have been conducted in areas to the west of the proposed Facility site at Terminal 5 (URS 2011a, 2011b), to the east at Berth 10 at Terminal 4, and at Berth 8 and 9 at Terminal 3 (L.R. Squier Associates 1976 and 1981, Dames & Moore 1985). On land, these investigations have typically encountered near-surface sandy dredged fill, underlain by fine-grained silt and clay alluvium deposits, then loose to medium dense sand alluvium, overlying the dense Troutdale gravel deposit.

The layers of silt and clay found beneath the artificial fill are generally soft and considered compressible. Such soils are potentially susceptible to settlement under static loading (from the weight of overlying structures). In addition, the shallow alluvial sand is potentially susceptible to soil liquefaction at high levels of seismic shaking and capable of significant dynamic settlement/lateral spreading deformation. (Soil liquefaction processes are described below under Seismic Hazards.)

At nearshore and offshore locations to the east of the proposed Facility site, previous investigations have typically encountered 5 to 20 feet of the loose to medium dense sand or silty sand overlying the dense Troutdale gravel deposit. At nearshore and offshore locations at Terminal 5 to the west of the proposed Facility site, the thickness of sand overlying the dense Troutdale gravel ranged from 40 to 60 feet. Depths to the Troutdale gravels at the proposed Facility site vary, generally increasing with proximity to the shoreline, up to approximately 60 to 80 feet.

Topography

Artificial fill material and grading have modified the former topography at the proposed Facility site over the last century. The ground surface in the upland portions of the area is relatively flat today, ranging in elevation from approximately 22 to 35 feet above sea level (National Geodetic Vertical Datum [NGVD] 1929). Slope instability is, therefore, not a concern in upland areas at the proposed Facility site. The slope along the riverbank near the marine terminal, however, is substantial, with a horizontal run to vertical rise of approximately 2:1. Potential erosion in this area is currently controlled by a covering of riprap. The existing topographic relief in areas within the proposed Facility site is described in Table 3.1-1.

Table 3.1-1. Existing Topographic Relief at the Proposed Facility Site

Area	Topographic Relief
Unloading and Office Area (Area 200)	The land surface in Area 200 and along the alignments of existing and proposed rail infrastructure is relatively flat, with elevations ranging from approximately 28 to 35 feet ASL (NGVD 1929).
Storage Area (Area 300)	Elevations in Area 300 range from 27 to 30 feet ASL, and thus the ground surface is essentially flat. Area 300 has been surfaced with crushed rock in the western half and sand fill in the eastern half.
Marine Terminal (Area 400)	The top of the riverbank at the trestle abutment is at an elevation of 27 feet ASL and slopes down to a flat sandy beach at 17 feet ASL. The slope along the bank is 51 percent, with a horizontal run to vertical rise of 2:1, and is surfaced with riprap to protect against erosion. The dredge line at the face of the dock is at an elevation of approximately -40 feet ASL. The berths are permitted for dredging to an elevation of -43 feet ASL to allow for anticipated marine vessel traffic. Above the riverbank, Area 400 is relatively flat, with a ground surface of approximately 27 feet ASL. The ground is covered with a mixture of pavement, gravel, and grass. Four infiltration/water quality swales are located on the northern side of Area 400 that range in depth from approximately 2 to 4 feet.
Transfer Pipelines (Area 500)	The ground surface along the transfer pipeline alignment is relatively flat and ranges in elevation from approximately 22 to 32 feet ASL. The ground is typically surfaced with crushed rock, with some paved areas, including NW Gateway Avenue and Harborside Drive.
Boiler Building (Area 600)	Elevations in the boiler building area range from 28 to 35 feet ASL, making the area relatively flat (NGVD 1929).

ASL = above sea level, NGVD = National Geodetic Vertical Datum

3.1.2.2 Rail Corridor

Geology

The rail corridor within Washington would traverse the Columbia Plateau and the Cascade Mountain Range geologic provinces to reach the Portland Basin. These geologic provinces consist of volcanic and sedimentary rocks of varying composition and texture. The rail corridor from Williston, North Dakota, to the Washington-Idaho border would pass through very diverse geologic environments. The Great Plains geologic province in the eastern portion of the corridor consists of east-dipping surfaces formed by deposition of sediment eroded from the uplifting Rocky Mountains. The Rocky Mountains consist of individual ranges of peaks and valleys of diverse rock types of varying composition and texture.

Soils

Numerous soil types are found along the rail corridor within Washington. Soils vary with parent rock, with the diverse elevation along the route, as well as the varied climates along the proposed rail route. Numerous soil types are found along the out-of-state rail corridor from Williston, North Dakota, to the Washington-Idaho border.

Topography

Within Washington, the rail corridor traverses the high elevations of the Columbia Plateau and the Cascade Mountain Range geologic provinces, down to near sea level within the Portland Basin. Elevations along the rail corridor between Williston, North Dakota, and the Washington-Idaho border are diverse. The Great Plains geologic province in the eastern portion of the corridor is relatively flat. The rail corridor rises and falls on its passage through the Rocky Mountains of Montana and Idaho.

3.1.2.3 Vessel Corridor

Geology

Bedrock outcrops are varied along the lower reaches of the Columbia River. Most bedrock is buried beneath river sediments. Beyond the 3-nmi boundary, bedrock outcrops are varied along the Pacific coastline of the United States and Canada.

Soils

Sediments along the Columbia River bottom include a diverse array of sands, silts, and clays. Shoreline soils are varied and generally support significant vegetation. Beyond the 3-nm boundary, sediments along the Pacific Ocean floor include a diverse array of sands, silts, and clays. Shoreline soils vary from sandy beaches to deep soils supporting mature forests.

Topography

Topography on the Lower Columbia River is at or slightly above sea level. Shoreline topography varies significantly. Topography along the vessel corridor beyond the 3-nmi boundary is at sea level on average, with daily fluctuations from tidal influence.

3.1.2.4 Geologic Hazards

A discussion of regional and general geologic hazards that could impact the proposed Facility, operations along the rail corridor, and/or operations along the vessel corridor are presented below. Following the general discussion, specific hazards that could impact the proposed Facility, the rail corridor, and the vessel corridor are presented.

Regional Earthquake Hazards

Earthquake hazards in the Pacific Northwest are primarily related to the convergence of the North American and Juan de Fuca tectonic plates, which forms the subduction zone known as the CSZ. The main seismic hazards associated with earthquakes in the region are fault rupture, ground motion, soil liquefaction, and tsunamis and seiches.[5] The level of these seismic hazards in the Pacific Northwest varies from low to high depending on the location within the region, as indicated by historical seismicity, regional geological, geophysical and tectonic data, and aerial imagery. Figure 3.1-3 shows the generalized seismic hazard potential in the Pacific Northwest Region. A higher value (>0.8 being the highest shown in red on the figure) indicates a higher seismic hazard potential and a lower value (0.06-0.01 is the lowest shown in blue on the figure) indicates a lower seismic hazard potential. See Appendix C for a full discussion of the region's historical seismicity.

The size of a given earthquake is measured by seismometers and reported as a magnitude. The most commonly used magnitude scale is the Moment Magnitude, often expressed as M_w, which is an improved, updated scale, similar to the Richter scale. The scale is logarithmic, meaning that an earthquake of magnitude 6, for instance, is 10 times stronger than one of magnitude 5. The smallest earthquakes rate as just a fraction on the scale, and the largest potential earthquake could be significantly greater than a magnitude 10. Earthquakes smaller than magnitude 3 are generally not perceived by people. The largest earthquake ever recorded was a magnitude 9.5 (Chile, 1960) but certainly earthquakes in the past would rate higher on the scale, and such massive earthquakes could occur again. Table 3.1-2 describes the effects that earthquakes of various magnitudes could have on buildings and other structures.

Table 3.1-2. Potential Seismic Effects in Relation to Earthquake Magnitude

Earthquake Magnitude (M_W)	Perception or Effect
Less than 2.0	Microearthquakes, not felt.
2.0–2.9	Generally not felt, but recorded.
3.0–3.9	Often felt, but rarely cause damage.
4.0–4.9	Noticeable shaking of indoor items, rattling noises. Significant damage unlikely.
5.0–5.9	Can cause major damage to poorly constructed buildings over small regions. At most slight damage to well-designed buildings.
6.0–6.9	Can be destructive in areas up to about 100 miles across in populated areas.
7.0–7.9	Can cause serious damage over larger areas.
8.0–8.9	Can cause serious damage in areas several hundred miles across.
9.0–9.9	Devastating in areas many hundreds to several thousand miles across.
10.0+	Never recorded, widespread devastation across very large areas

Source: USGS 2015

5 Seiches are oscillatory waves that pass back and forth across enclosed or partially enclosed waterbodies such as lakes, bays, or rivers.

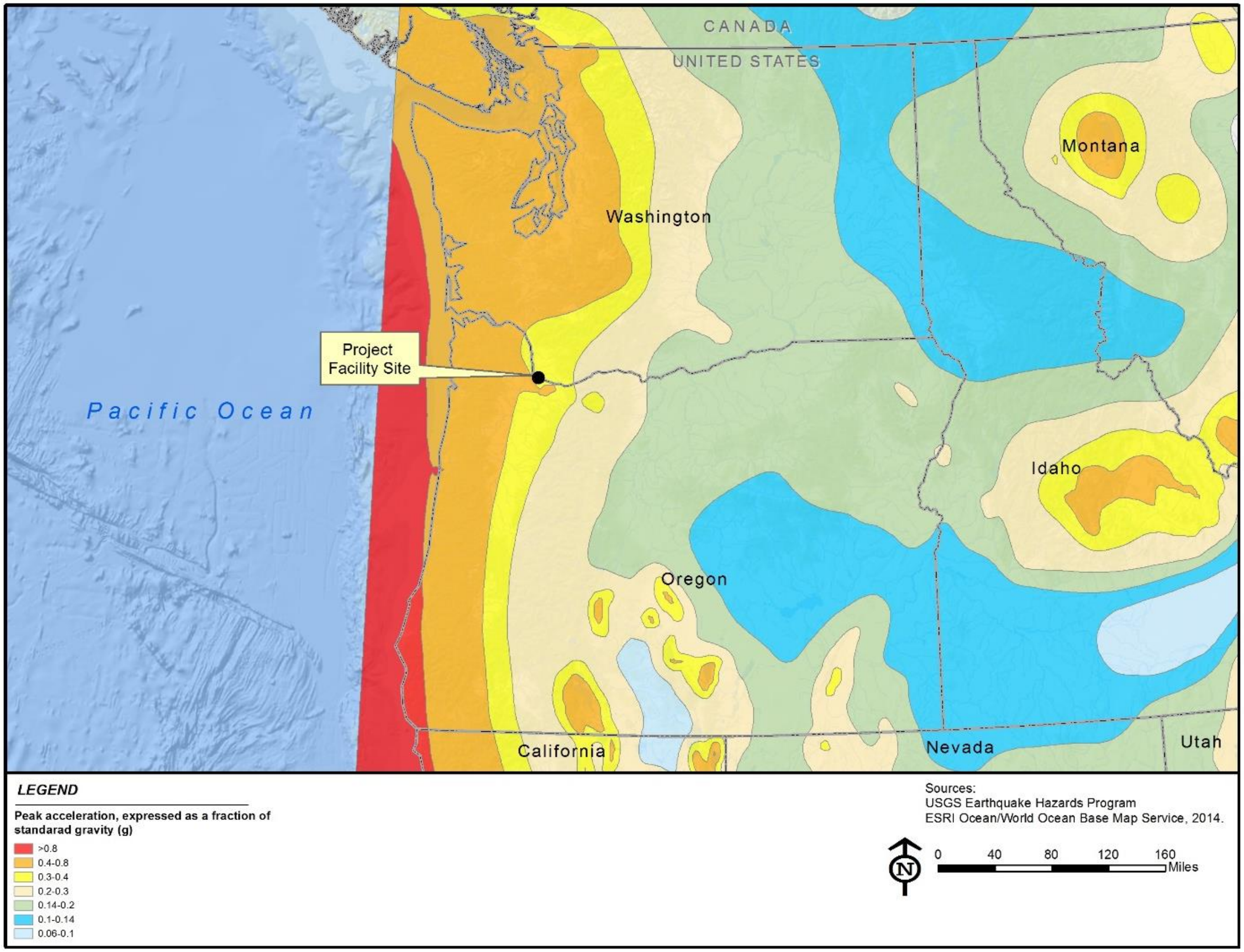


Figure 3.1-3. Seismic Hazard Potential in the Pacific Northwest Region

Note: The higher the peak seismic ground acceleration in an area, the higher the seismic risk in that area.

Five types of regional earthquakes could impact the site of the proposed Facility or rail and vessel corridors:

- CSZ megathrust earthquakes that originate at the plate boundary
- CSZ intraplate earthquakes that occur deep within the subducting plate
- Shallow crustal earthquakes that originate along fault zones
- Shallow crustal earthquakes that are not associated with faults
- Volcanic earthquakes that occur beneath the region's active volcanoes

These seismic sources are depicted on Figure 3.1-4 and are described below.

The convergence of the Juan de Fuca and the North American tectonic plates along the CSZ can generate megathrust earthquakes. These events result from the sudden rupture between the upper surface of the Juan de Fuca tectonic plate and the lower surface of the North American tectonic plate (Figure 3.1-4). Rupture may occur along one segment of the subduction zone or along its entire length. Subduction zone earthquakes are not a frequent occurrence, but when they do occur, they are capable of producing massive earthquakes, larger than a magnitude 8. No subduction zone earthquakes have been directly recorded in the Pacific Northwest in historic times, but geologic evidence along the Pacific coast, from Northern California to British Columbia, indicates that multiple CSZ megathrust earthquakes of magnitude 8 to 9 and greater have occurred during the last 10,000 years (e.g., Atwater et al. 1995, 2005; Clague at al. 2000; Kelsey et al. 2005; Nelson et al. 2006). In addition to onshore data, deposits of submarine landslides believed to be triggered by CSZ megathrust earthquakes are found offshore of the region (Blais-Stevens et al. 2011; Goldfinger et al. 2012, 2013). Goldfinger et al.'s (2012) data indicate that magnitude 8 to 9+ megathrust events on the CSZ occur every several hundred years on average, with events on the southern portion of the CSZ (in southern Oregon and California) occurring approximately twice as frequently as on the northern portion. Historical evidence of tsunami inundation in Japan indicates the last CSZ megathrust earthquake occurred on January 26, 1700, and was between magnitude 8.7 and 9.2 (Satake et al. 2003, Atwater et al. 2005).

As the Juan de Fuca plate subducts, the increase in pressures within the plate can lead to deep intraplate earthquakes. Earthquakes deeper than ~20 kilometers have been generated by the CSZ intraplate zone (Figure 3.1-4). Intraplate earthquakes are generally of smaller magnitude and deeper than megathrust earthquakes. Most CSZ intraplate seismicity is concentrated in the Puget Sound region and has generated such historic events as the 1949 Olympia earthquake of magnitude 6.9, the 1965 Seattle-Tacoma earthquake of magnitude 6.7, and the 2001 Nisqually earthquake of magnitude 6.8. Historical intraplate earthquakes near the proposed Facility site have not been recorded.

The convergence at the subduction zone also compresses the entire inland region, creating widespread faults, or fractures, in the earth. Crustal earthquakes occur during the rupture of shallow faults at depths of up to approximately 15 miles (Figure 3.1-4). Earthquakes can also be generated within the shallow crust away from known active faults.

Volcanic earthquakes are not caused by tectonic plate motion, but rather by the movement of magma upward beneath active volcanoes. These earthquakes are localized to volcanic centers and rarely impact areas distant from the volcano. In the case of large volcanic eruptions, such as that of Mt. St. Helens in 1980, volcanic earthquakes may cause shaking several miles distant from the volcano.

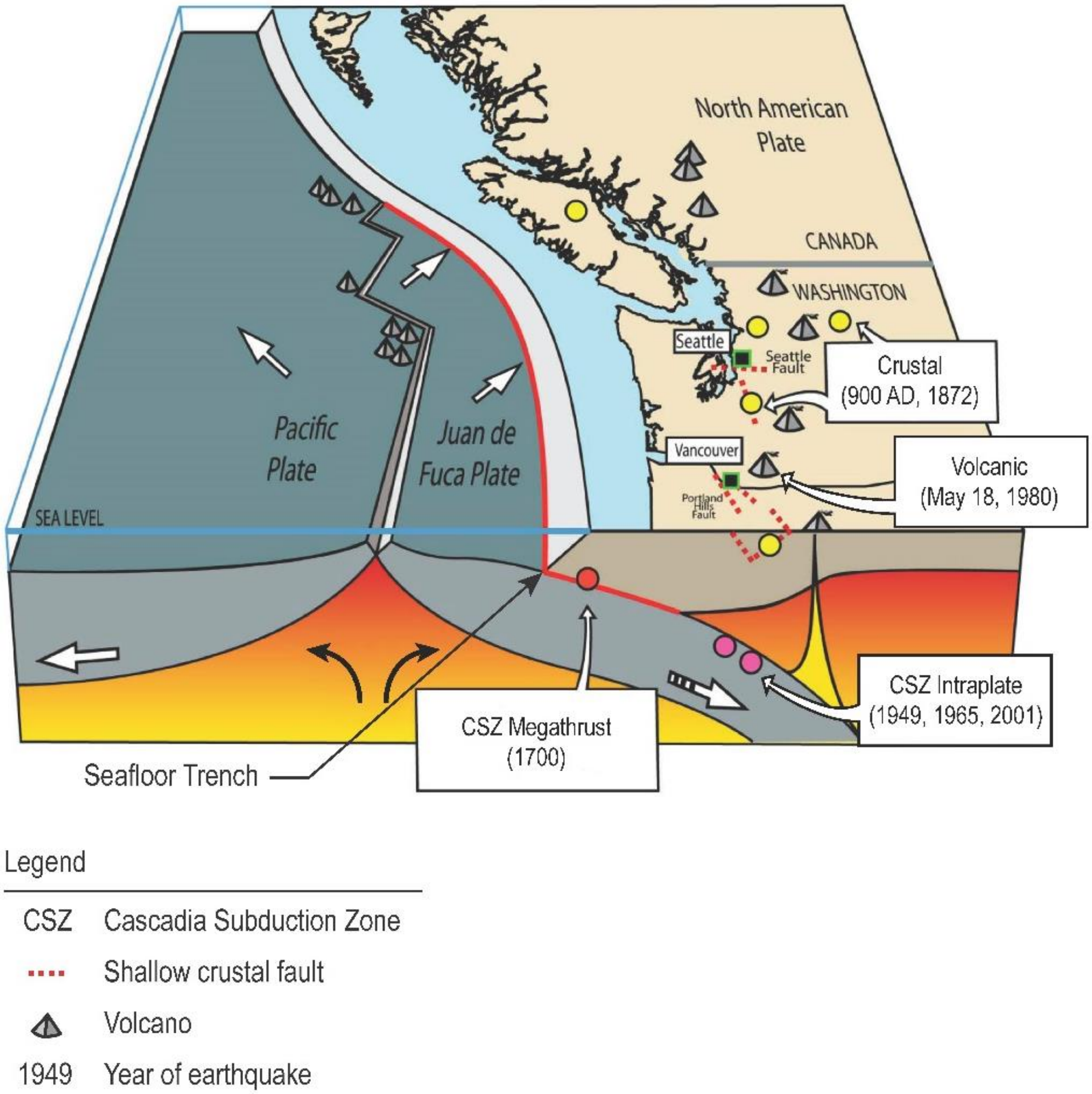


Figure 3.1-4. Tectonic Setting, Seismic Sources, and Significant Earthquakes
Modified from: USGS (2002) and Figure 3.1-2 in EFSEC (2013)

Fault Rupture

The initial motion along a fault (fault rupture) causes compressional seismic waves that release strong jolts of energy on the surface. Fault rupture can lead to structural damage of nearby buildings, bridges, and other infrastructure. If infrastructure is located directly on top of a fault that ruptures, damage can be significant.

Ground Motion/Shaking

Following an initial fault rupture, seismic waves cause shaking of the ground surface. The ground shaking that occurs during an earthquake is generally what causes damage to overlying structures, especially when the shaking lasts for more than a minute. Earthquake damage from ground motion at a given location depends on the properties of the arriving seismic waves, properties of the soil at the site, and the structures involved. The amount of ground motion that may occur during an earthquake can be predicted based on the rock and soil properties in a given area. The peak ground acceleration (PGA) is a measure of the largest increase in velocity (acceleration) experienced by the ground surface during an earthquake. A similar measurement is the spectral acceleration (S_a), which is a measure of the largest increase in velocity experienced by a building or structure during an earthquake. These ground motion scales are measured in units of acceleration due to gravity (g). Low PGA and S_a values would indicate that seismic waves on the ground or passing through structures, respectively, would cause only minor ground motion (shaking), whereas a high PGA would indicate that seismic waves would generate high levels of shaking. Technical information on PGA and S_a ground motion calculations are provided in Appendix C.

Soil Liquefaction

Soil liquefaction is the temporary change of a solid soil or sediment into a soil with fluid properties. Earthquake ground motions can increase the pore pressure of saturated soils causing the soil to deform like a dense fluid. The potential for liquefaction increases if seismic shaking is prolonged. Megathrust earthquakes tend to have the longest duration ground motion and, thus, are most likely to lead to liquefaction. Soils and sediments most susceptible to soil liquefaction are saturated soils that lack cohesion. Loose to medium-dense sand or soft to medium-stiff, low-plasticity silts are particularly vulnerable. Liquefaction can result in entire blocks of soil sinking downward and spreading laterally into surrounding areas including riverbanks or stream channels. This settlement can contribute to the loss of some bearing capacity for both shallow and deep foundations. Structures can be adversely affected by liquefaction-induced dynamic settlement and reduced bearing capacity. Lateral displacement may range from a few inches to many feet depending on soil conditions, the steepness of the slope, and the magnitude and the distance from the earthquake epicenter.

Tsunamis and Seiches

Tsunamis are water waves typically generated in ocean environments by earthquakes that displace the seafloor (most often near subduction zones). Submarine landslides that may or may not be induced by earthquakes are another common source of tsunamis. Landslides that are initiated on land and enter waterbodies with enough force to displace water can also cause waves. These smaller, localized tsunamis can occur along rivers, lakes, or ocean shorelines. In extreme cases, offshore volcanic eruptions that displace large volumes of seawater, such as the 1883 Krakatoa eruption in Indonesia, can also cause tsunamis. Tsunami waves can reach from a few to tens of feet in height and can inundate coastal and nearby low-lying inland areas. Tsunami risk is greatest near ocean shores and near river mouths.

Seiches are oscillating water waves that can occur in any enclosed or partly enclosed waterbody, including rivers. They result from earthquake activity, volcanic activity, landslides, or extreme wind or weather events (USGS 2015, Earthquake Hazards Program). Seiches become hazardous when their extreme vertical waves reach shallow water or shorelines. After the 1964 Alaska earthquake, very minor (less than 1-foot) seiches were reported in the upper (nonfree-flowing) section of the Columbia River system from McNary Reservoir (McNary Dam) to Franklin D. Roosevelt Lake (Grand Coulee Dam) (McGarr and Vorhis 1965).

Proposed Facility Earthquake Hazards

The potential impacts to the proposed Facility from earthquake hazards are presented below.

Fault Rupture

Based on the mapping of Quaternary age faults (less than 1.6 million years old) the USGS and others conducted in the Project vicinity, the East Bank, Portland Hills, and Oatfield faults to the southwest and the Lacamas Lake Fault to the east are considered active or potentially active faults (Phillips 1987, Mabey et al. 1993, Lidke et al. 2003, Personius et al. 2003, USGS 2006, Washington Division of Geology and Earth Resources 2013, Czajkowski and Bowman 2014, DOGAMI 2015a). The mapped traces of these faults are approximately 4 to 10 miles from the Port at their closest approach (Figure 3.1-5). None of the faults extend through, or project toward, the proposed Facility site. Thus, no potential for surface fault rupture exists at the site of the proposed Facility from these or other known active regional faults.

Ground Motion/Shaking

Earthquakes originating along the CSZ are capable of producing significant shaking at the proposed Facility site. The USGS has classified the proposed Facility site region as an area of moderate to high ground-motion hazard (Petersen et al. 2014). Nearby shallow crustal earthquakes would be unlikely to generate substantial ground-motion hazard.

Liquefaction

Soils at the Port are largely composed of sand and silt and are often saturated due to the high water table/shallow groundwater. The proposed Facility site has been identified as having moderate to high liquefaction-susceptible soils (Palmer et al. 2004) (see Figure 3.1-6).

Based on the geotechnical studies described previously, soil layers underlying the proposed Facility site primarily comprise silt and sand of varying strength down to approximately 60 to 100 feet bgs. Some of these soils fall within the National Earthquake Hazards Reduction Program Site (NEHRP) Class F, meaning they are unstable soils prone to liquefaction during very strong ground motion. These soils are underlain by the dense Troutdale gravel, which falls within NEHRP Site Class C, meaning the gravel is very resistant to liquefaction. Given potential site ground motions (without proposed ground improvements), liquefaction-induced settlements of the Site Class F soils could be approximately 10 to 16 inches in the vicinity of the unloading and office area (Area 200) and the boiler building (Area 600); 6 to 10 inches in the storage area (Area 300); 3 to 15 inches in the vicinity of the transfer pipelines (Area 500); and 12 to 24 inches at the marine terminal (Area 400) (GRI 2013).

Failure-prone soils are commonly improved through a variety of ground improvement engineering techniques. These techniques aid in strengthening soft and loose soils so that they are less prone to liquefaction, capable of withstanding greater seismic motion without failure, and better equipped to support structures. Ground improvements proposed by the Applicant are described in Section 2.3.2.2. The Applicant-proposed ground improvements are designed to increase the strength of the underlying soils. EFSEC's independent consultant's review of the Applicant-proposed ground improvements recommends that more extensive application of these ground improvements within site soils should occur beneath the transfer pipelines (Area 500) that connect to the storage tanks (Area 300) and the marine terminal (Area 400) (Section 3.1.5). These additional ground improvements are needed because the Applicant-proposed ground improvements do not uniformly reach the top of the NEHRP Site Class C Troutdale gravel in this area.

Tsunamis and Seiches

Significant tsunamis in the proposed Project vicinity would most likely result from a CSZ earthquake or a more distant earthquake from the Pacific Rim (such as Alaska, Chile, or Japan). For example, the 1964 Alaska earthquake of magnitude 9.2 generated a large tsunami that impacted the Pacific Northwest coast and caused significant damage to the coastal town of Crescent City, California. Prehistoric tsunami deposits interpreted to be associated with CSZ earthquakes have been identified and dated at multiple locations along the Oregon and Washington coasts. However, the proposed Facility site is approximately 103.5 miles up the Columbia River from the Pacific coast and is at an approximately 25- to 35-foot elevation above mean sea level. Given this distance and elevation and previous modeling of potential tsunami inundation associated with a large CSZ earthquake, tsunamis are not considered a hazard at the proposed Facility site (Walsh et al. 2000, DOGAMI 2015b). No historical seiches are known to have occurred within the Lower Columbia River. It is, therefore, unlikely that seiches could affect the proposed Facility site.

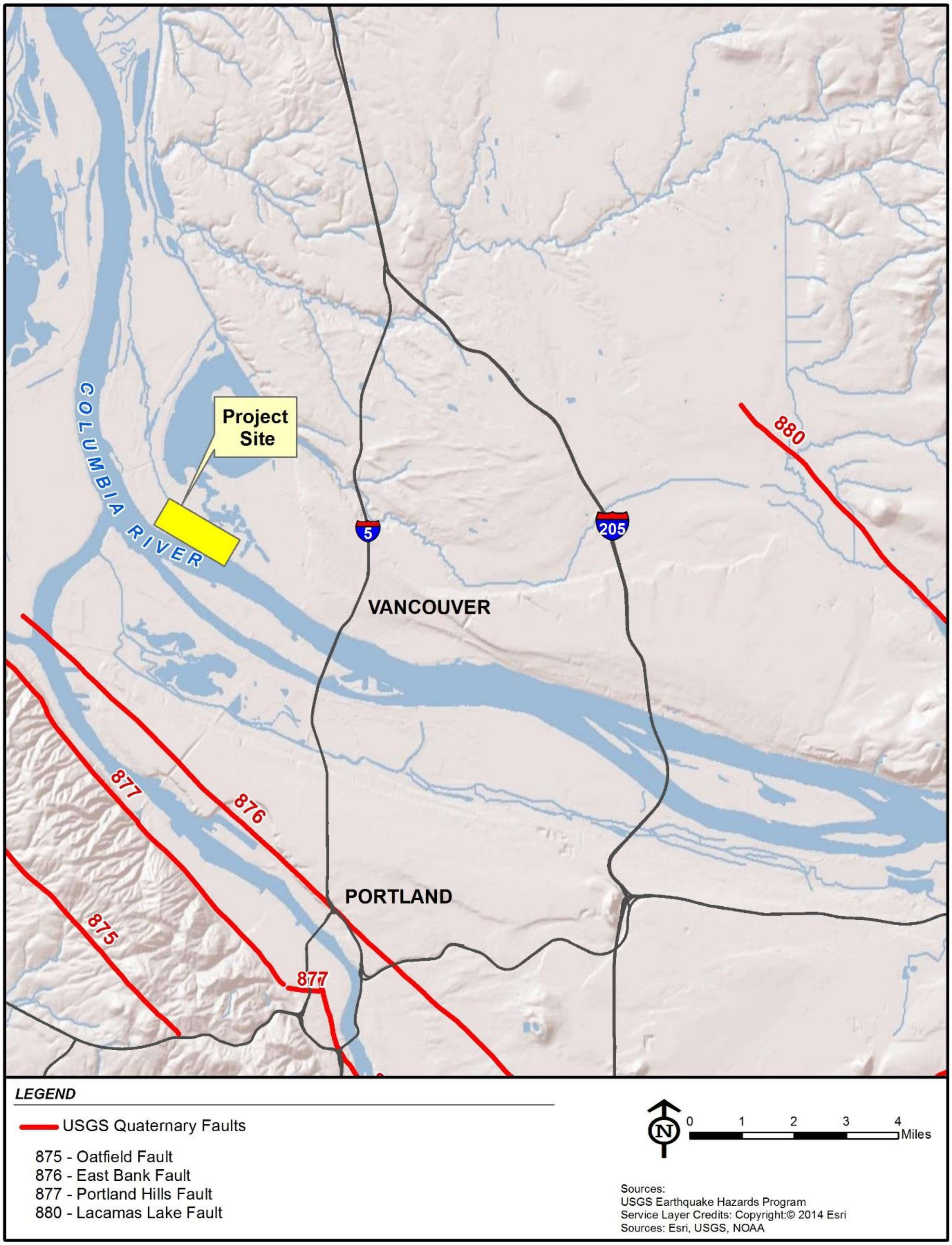


Figure 3.1-5. Local Faults

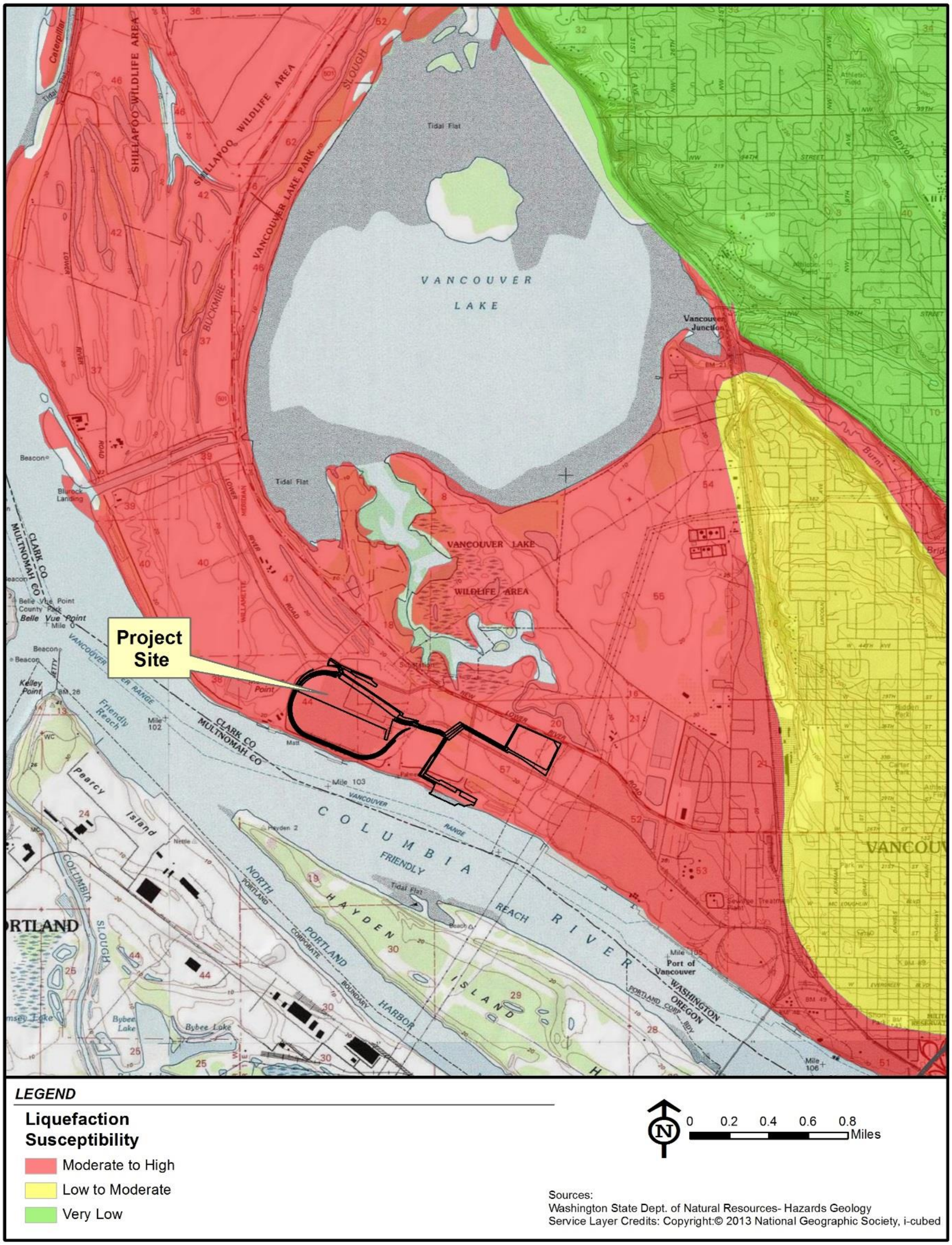


Figure 3.1-6. Liquefaction Susceptibility

Rail Corridor Earthquake Hazards

Seismic hazards along the rail corridor generally diminish from west to east from the proposed Facility site toward the Washington-Idaho border. Due largely to the proximity of the CSZ, the seismic hazards along the rail corridor in western Washington are similar to those described above for the proposed Facility site. Seismic activity is well documented across all of Washington, with many historic earthquakes recorded (see Appendix P.1, Mapbook K3A, and Appendix C). Seismic hazards along the rail corridor in Washington include fault rupture, ground motion, and soil liquefaction. Only one fault system less than 15,000 years old (the Wallula Fault) crosses the rail corridor south of Kennewick. Appendix C provides a detailed description of the ground motion hazard along the in-state rail corridor. Western Montana and Idaho have some areas of elevated seismicity. Seismic hazards are typically low in the eastern portion of the rail corridor through eastern Montana and North Dakota. Large-scale earthquake-induced tsunamis occur in marine environments and would, therefore, not be encountered along the rail corridor.

Vessel Corridor Earthquake Hazards

Tsunamis generated by earthquakes from the CSZ are a potential hazard for marine vessels near the Lower Columbia River mouth and in nearshore environments along marine routes in the Pacific Ocean.

General Landslide Hazards

Landslides include rockfalls, slides, slumps, and debris flows. Gravity is the dominant force behind landslides, but the motion of water, wind, or large-scale disturbances such as earthquakes and volcanic activity can also trigger them. Steep and/or unstable slopes are at greatest risk of producing landslides. Other factors in landslide potential include soil type and thickness; geologic structure; vegetative cover; soil conditions and soil saturation; and the amount, rate, and duration of precipitation. Landslide hazard areas are typically defined as areas that, due to a combination of slope inclination, soil type, geologic structure, and the presence of water, are susceptible to failure and subsequent downhill movement.

Proposed Facility Landslide Hazards

No landslides have been mapped in the proposed Project vicinity (Fiksdal 1975, Phillips 1987, Washington Division of Geology and Earth Resources 2014). Based on the relatively flat topography at the proposed Facility site, landslides are not considered a potential hazard.

Rail Corridor Landslide Hazards

Potential exists for landslides along steep slopes within the rail corridor. According to mapping the WDNR completed, the areas within the rail corridor in Washington that are most prone to landslides are in the Columbia River Gorge in Skamania County and near Bingen in Klickitat County (see Appendix P.2, Mapbook K2A). Landslides are present along other areas of the rail corridor but mapped deposits occur less frequently. Zones of “High Landslide Incidence” occur along approximately 62 miles of the rail corridor along the Columbia River, and zones of “Moderate Landslide Incidence” occur along approximately 16 additional miles of the rail corridor (Sheets 5 to 9 of Mapbook K2A, Appendix P.2). These landslide zones are in the central to western portion of the rail corridor paralleling the Columbia River in Washington. A 4-mile stretch, mostly on the northern side of the rail corridor, is classified as having a “Certain” landslide probability according to the WDNR (Sheet 8 of Mapbook K2A, Appendix P.2). This location is where the very large ancient Bonneville Landslide occurred near the town of Cascade Locks, Oregon. The landslide originated from the Washington side and temporarily blocked the Columbia River (O’Connor and Burns 2009). WDNR also reported additional movement of landslide material in that vicinity in 2007 (Washington Division of Geology and Earth Resources 2007). The USGS has recently remapped landslides in the western portion of the Columbia River Gorge in Washington using Light Detection and Ranging ([LiDAR]) (Pierson et al. 2014). This mapping indicates that within the USGS study area, landslides are more numerous and complex than previously mapped and cover approximately 65 percent of the study area. Six currently active landslides were identified.

Vessel Corridor Landslide Hazards

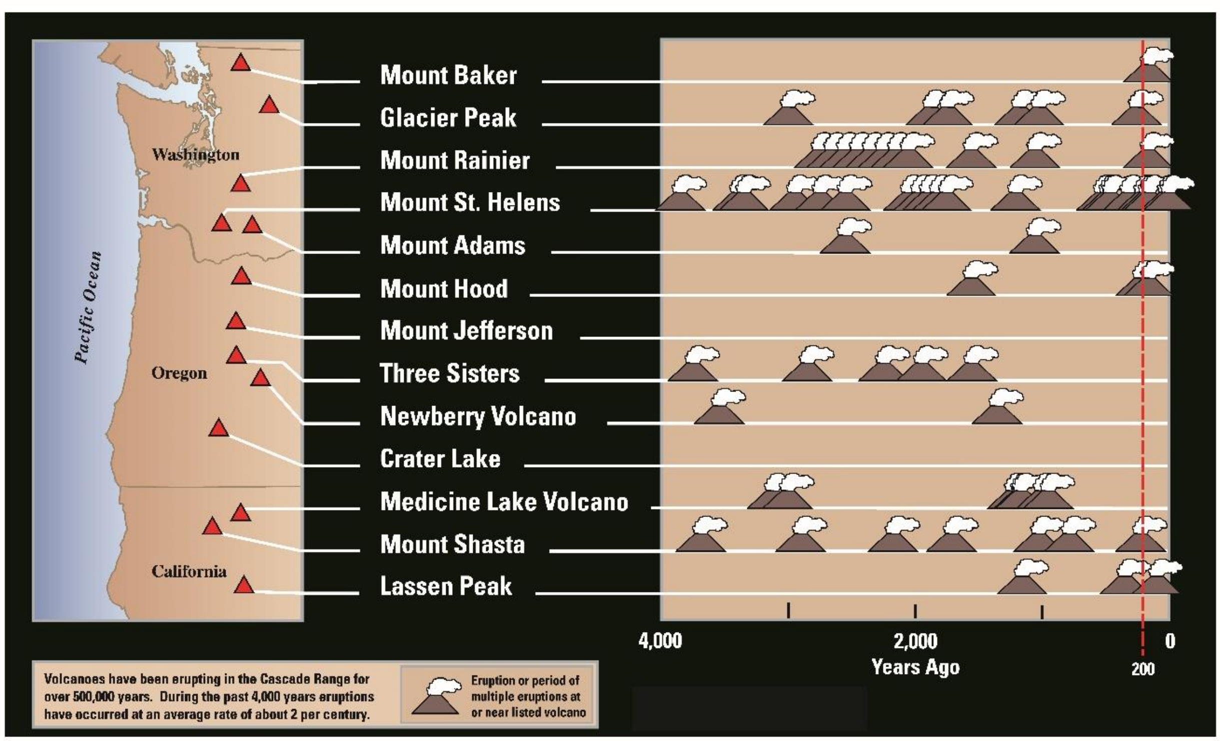
Landslides could occur along the shorelines of the Lower Columbia River within the vessel corridor or along various areas of the Pacific coast. Subsea landslides resulting from an earthquake along the CSZ could also occur. Subsea landslide-generated tsunamis could extend some distance into the Columbia River from the mouth.

Regional Volcanic Hazards

Active volcanoes within the Cascade Range occur from Northern California to British Columbia, Canada (Figure 3.1-7). Additionally, extinct volcanoes and cinder cones occur within the Boring Lava Field, which extends from Boring, Oregon, to southwestern Washington.

Mt. St. Helens and Mt. Hood are both active volcanoes, capable of producing significant explosive eruptions with tephra/ash fall, debris flows, lava flows, pyroclastic flows, lahars, and landslides. In the event of an eruption, impacts to areas near the volcanoes could be significant.

Tephra/ash falls result from explosive volcanic activity. Tephra includes any airborne volcanic ejecta, from microscopic particles of ash up through moderately sized cinders and large volcanic bombs. Large airborne ejecta that fall out of the eruption column near the volcanic vent produce a significant hazard at the site of the eruption. Volcanic ash, however, can become suspended in the air and can travel great distances entrained in the wind. It can travel tens to hundreds of miles from an eruption site and, in extreme cases, ash suspended in the upper atmosphere can circle the globe. Volcanic ash is mostly composed of sharp shards of volcanic glass that can abrade surfaces. In high concentrations, ashfall can also create respiratory distress for people, especially those suffering from asthma.



Source: USGS (Myers and Driedger, 2008)

Volcanic Eruptions of Cascade Volcanoes
During the Past 4,000 Years

Figure 3.1-7. Cascade Volcanoes

Lahars are volcanic mudflows, composed of volcanic ash and other debris, mixed with water from rainfall, streams, or snow- and icemelt. They are generally generated during and after significant eruptions, when large volumes of loose volcanic ash are present along the flanks of a volcano. Lahars may continue to mobilize loose debris for years after the event. They typically move very quickly and are capable of destroying bridges, roads, and other infrastructure along drainages.

Debris flows are similar to lahars, but contain a much higher concentration of rock and debris and less water. They are not mobilized as easily as fluid lahars, but are extremely dense, and can be significantly more damaging. Lava flows emanating from the Cascade Range volcanoes tend to be higher-viscosity, slow-moving flows that do not travel great distances. Ancient lava deposits are present at depth beneath the proposed Facility site and at various locations along the rail corridor. These lavas were deposited between 15 and 16 million years ago during a very different volcanic regime. The volcanic vents that produced these lavas are no longer active.

Pyroclastic flows are chaotic blasts of volcanic ash, hot gases, and other rock and debris. Unlike lava flows and lahars, they will not necessarily follow existing drainages, and can spread out in any direction from a volcanic vent at very high speeds causing significant damage.

Massive landslides can occur if portions of a volcano collapse during a large eruption (e.g., Mt. St. Helens, May 1980). Significant volcanic activity is generally preceded by weeks to months of increased seismicity and other eruptive indicators. The Cascades Volcano Observatory/USGS maintains an advanced seismic network on regional volcanoes, including multiple seismic stations on both Mt. St. Helens and Mt. Hood. This observatory conducts constant real-time monitoring of seismic activity at these volcanoes. If data were to suggest an impending eruption, widespread warning would be given throughout the region, allowing for measures to be implemented to protect personnel and equipment.

Proposed Facility Volcanic Hazards

The two closest volcanoes to the proposed Facility are Mt. St. Helens, an active volcano located 45 miles to the northeast of the Port, and Mt. Hood, a potentially active volcano 50 miles to the southeast. Mt. Adams is located 70 miles to the northeast of the proposed Facility. Prevailing winds in the Pacific Northwest are toward the east/northeast. Ashfall from nearby volcanic eruptions is most likely to be carried eastward with the prevailing wind. Some ashfall could reach the proposed Facility site, but it is not likely in significant quantities. USGS estimates a 0.01 to 0.02 percent annual probability of depositing 4 inches or more of ash in the vicinity of the proposed Facility from an eruption in the Cascade Range (Wolfe and Pierson 1995). Large lahars originating from Mt. Hood could enter the Columbia River and move downstream past the proposed Facility site. Lava flows, pyroclastic flows, debris flows, and volcanic landslides from the Cascade volcanoes are unlikely to reach the proposed Facility site. Ashfall could affect the proposed Facility if winds from the eruption area were favorable for ash reaching the Port.

Rail Corridor Volcanic Hazards

Volcanic hazards existing along the western end of the rail corridor are similar to those discussed for the proposed Facility. The rail corridor passes by Mt. Hood, Mt. Adams, and Mt. St. Helens at approximate distances of 20, 30, and 40 miles, respectively. In the event of a massive eruption, ashfall from any nearby volcanoes could reach portions of the rail corridor. No active volcanoes are known to exist in Idaho, Montana, or North Dakota (see Appendix P.1, Mapbook K3B).

Lahars and/or debris flows from an eruption of either Mt. Hood or Mt. Adams could extend down to the rail corridor in the Hood River valley (Mt. Hood) or White Salmon River and Klickitat River valleys (Mt. Adams) (Scott et al. 1995, Burns et al. 2012). Mt. Adams last erupted approximately 1,000 years ago and has erupted approximately every 4,000 to 5,000 years for the last 15,000 years (Scott et al. 1995). Mt.

Hood's two most recent eruptive periods occurred approximately 1,500 and 200 years ago. The most recent major eruptive period on Mt. Hood was between approximately 15,000 to 30,000 years ago (Scott et al. 1997).

Vessel Corridor Volcanic Hazards

Mt. Hood, Mt. Adams, and Mt. St. Helens are relatively close to the vessel corridor along the Columbia River. Active volcanoes are present relatively close to the coast along the western United States and into southern Canada. In Alaska and Hawaii, active volcanoes are present along coastlines that may be close to marine vessel routes.

3.1.3 Impact Assessment

Impacts of the Proposed Action on earth resources would include soil erosion and modification to topography. These impacts could occur during construction, operation and maintenance, and decommissioning. Geologic hazards that could be potential impacts to the proposed Project include seismic hazards, tsunamis and seiches, landslides, and volcanic hazards. Because geologic hazards vary with location and could occur at any phase of the proposed Project, they are discussed separately below.

The timeframe of Project activities considered in this impact analysis includes construction, operations and maintenance, and decommissioning, which are collectively expected to last 20 years. Potential impacts on earth resources from accidental oil releases or fires requiring emergency response are discussed separately in Chapter 4. Exposure to soil contamination at the proposed Facility is discussed in Section 3.8.

3.1.3.1 Proposed Facility

Geology

Construction, Operation, and Decommissioning

Bedrock is not exposed at the proposed Facility. Therefore, no impacts would occur to bedrock geology during the construction, operation, or decommissioning phases of the proposed Facility.

Soils

Construction

Impacts to soils during construction at the proposed Facility include a negligible to minor, temporary increase in soil erosion. Short-term disturbance of surface soils would occur during construction activities related to site clearing, grading, filling, excavation of areas for foundation construction and utility placement, excavation and trenching for loop track foundations, associated piping, construction of underground segments of transfer pipelines, and installation of ground improvements. Heavy construction vehicles may also contribute to soil compaction, which reduces infiltration of water on the soil surface, leading to increased runoff and subsequent erosion. The erosion potential of soils during construction would be minimized through the implementation of erosion and sedimentation BMPs (outlined below).

Native soils at the proposed Facility site have largely been replaced or covered with artificial fill throughout the Port's history. Soil erosion that could occur during Facility construction would impact mostly artificial fill that overlays native soils, and the natural soil horizons below the fill would be less affected.

Weak soils susceptible to failure in the storage area, marine terminal, and transfer pipelines (Areas 300, 400, and 500) would require ground improvement techniques, including installation of vibroreplacement stone columns, soil mixing, or jet grouting. These ground improvements would permanently alter the density, composition, and permeability of affected soils. An estimated 160,000 cubic yards of aggregate and 18,000 tons of cement would be used for ground improvements (materials sourced offsite). Construction of temporary benching in the shoreline area during installation of the ground improvements would temporarily disturb existing ground surfaces and expose soils to wind and stormwater runoff, potentially causing erosion.

Excess soils would be generated due to various construction activities, including excavation of trenches, removal of unsuitable soils during placement of structural fill, and the dry spoils generated during installation of ground improvements. The dry spoils from jet grouting, in particular, are estimated to be approximately 42,000 cubic yards. These soils and sediments would be disposed of offsite at a suitable facility or reused at other locations onsite where appropriate, such as for construction of the containment berm for the storage tank area. Structural fill would be necessary to level the ground surface in various areas of the site. The mobilization, temporary storage, and emplacement of these soils and fill would temporarily increase their erosion susceptibility.

Proposed modifications of the marine terminal (Area 400) would include in-water and overwater construction activities for the installation of mooring dolphins, dock platforms, walkways, and steel piles. In-water work would result in the disturbance of riverbed sediments that could suspend sediment within the water column and lead to increased turbidity. Installation of ground improvements in the marine terminal would likely generate sediment-laden water, which could flow into the Columbia River. Other work activities proposed for the marine terminal would occur above the ordinary high water mark (OHWM) and include the construction of the marine vapor combustion unit (MVCU), control room, maintenance parking area, and transfer pipeline. Construction in these areas may disturb soils and could lead to soil erosion.

The Applicant would implement these erosion and sedimentation BMPs to minimize the potential for soil erosion during construction:

- Construction activities would be controlled to limit the area of exposed soil.
- Disturbed areas would be graded and compacted, free from irregular surface changes, and sloped to drain.
- Disturbed areas would be surrounded with stabilized soil berms or sand bags to prevent erosion from affecting adjacent areas.
- Temporary ditches, sediment fences, straw matting, erosion control blankets, and silt traps would be installed as necessary to minimize the impacts of erosion.
- Sheet piles would be installed in the vicinity of jet grout installation operations with sufficient freeboard above the ground surface to contain wet spoils and sediment-laden water.
- All nonactive disturbed areas would be stabilized.

Following completion of foundations, the site would be filled, compacted, and brought up to final grade. Final grading and landscaping would consist of gravel-surfaced areas, asphalt-surfaced areas, concrete-paved surfaces, and vegetated areas.

In the final phase of construction, exposed ground surfaces would be stabilized in accordance with the requirements of the Facility National Pollutant Discharge Elimination System (NPDES) construction stormwater permit and final construction plans. Stabilization would minimize the potential for long-term erosion. Stormwater from newly constructed impervious surfaces would be collected and conveyed using constructed systems that avoid contact of stormwater with bare soils. Permanent erosion control would include construction of permanent structures and facilities with onsite stormwater collection systems. Surface features that would control erosion include buildings, hardscape pavements and gravel industrial yards, permanent landscape areas, vegetated swales, and onsite infiltration. Erosion control facilities would be designed to capture stormwater directly from hardscape surfaces to limit erosion. Industrial yard areas and landscaping areas would be designed to either allow for infiltration or use flow dispersion to avoid concentration of runoff that may contribute to erosive forces. Additionally, industrial yard areas would incorporate BMPs from the stormwater manual for soil erosion and sediment control at industrial sites.

Realignment of the existing natural gas line would involve excavation, placement of new line in a new location, filling, and placement of road-surfacing materials over the new alignment. The old section of line would be abandoned in place; aboveground facilities related to the boiler building (Area 600) would be constructed in this location, thereby stabilizing soils. Shifting portions of the two existing track loops (4106 and 4107) and constructing one additional loop (4101) could cause temporary exposure of ground surfaces. Following the shifting, ground surfaces would be stabilized to match surrounding conditions.

Bank erosion along the Columbia River would likely be a negligible impact from activities at the proposed Facility. Soils along the riverbank slope at the docks are currently protected with erosion-control measures (riprap). Bank erosion could occur along unprotected portions of the Columbia River riverbank, particularly during periods of elevated river levels and flooding. Erosion along the banks of the Columbia River is addressed in Section 3.3.

Eroded soil particles can enter surface water, increasing the turbidity of stormwater discharged to the Columbia River. Soil particles may also block stormwater catchment basins. To reduce sedimentation into the Columbia River, stormwater capture and filtration may be necessary as described above. These issues are fully addressed in Section 3.3. Eroded soils could also be transported from the site in the form of dust emissions and could be deposited on roadways or other areas. To reduce dust emissions, exposed dry soils would be watered during construction as needed. These air impacts are discussed in Section 3.2.

Operation

Soil erosion potential during Facility operation would be negligible. Once construction is completed, exposed ground surfaces would be stabilized in accordance with the methods described in the construction Stormwater Pollution Prevention Plan (SWPPP) (Appendix D.7). Operation and maintenance of the proposed Facility would not require additional excavation or disturbance of ground surfaces and, thus, no additional mitigation would be required.

Decommissioning

Decommissioning activities would likely be similar to construction activities in their potential for soil erosion impacts, with impacts anticipated to be negligible to minor, and temporary. Decommissioning would involve dismantling and removal of some aboveground Facility elements from the site, requiring some disturbance of the ground surface and some excavation. These activities may result in minor, temporary soil erosion. Soil erosion during decommissioning would be minimized through the implementation of erosion and sedimentation BMPs as described above. Surface soils would be stabilized at the completion of decommissioning activities.

Topography

Construction

Impacts to topography from construction of the proposed Facility would be negligible. Most areas of the Port have been graded, filled, and generally modified from their original state over the past several decades. The Port area today is relatively flat, and substantial site grading is not anticipated for the proposed Facility. Limited grading and/or placement of additional fill may be performed to obtain necessary grades for access roads, excavation of unloading trenches, piping trenches, building foundations, and leveling the ground in the storage tank area. Topography modification would be modest, limited in spatial extent, and in most areas, temporary.

The primary excavations related to construction of Facility elements would be in unloading and office area and storage area (Areas 200 and 300). The unloading and office area would require the excavation of 2 trenches approximately 1,800 feet long, 5 feet deep, and 10 feet wide for a volume of approximately 180,000 cubic feet. Associated pump basins would also require minor excavation in unloading and office area. The proposed storage area would be located in the Facility site's northeastern corner and would require excavation of pump basins and water quality vaults. The finished height of trenches and vaults at these locations is proposed to be at or slightly above ground level.

In addition, portions of Areas 300, 400, and 500 at the proposed Facility site would require ground improvement techniques including soil mixing, jet grouting, and/or installation of vibroreplacement stone columns (discussed under Seismic Hazards, below). During the jet-grouting process, an estimated 42,000 cubic yards of dry spoils would be removed from existing soils, temporarily lowering the elevation at those sites. Upon completion of jet grouting, these areas would be subsequently filled with structural fill and regraded to match the surrounding topography as needed. Other ground improvement techniques would compact/densify subsurface soils, which would also temporarily lower elevations in these areas. These areas would be subsequently filled with structural fill and regraded to match the surrounding topography as needed. Temporary benching of the shoreline in the marine terminal (Area 400) would also be required during installation of the ground improvements, to safely stage the necessary construction equipment. The benching would temporarily modify the topography of the shoreline area. After completion of construction activities, the shoreline area would be regraded to its previous configuration.

Excavation activities related to realignment of the natural gas pipeline would cause temporary modifications to topography. The location of the new pipeline would be regraded to match the surrounding topography. Construction of one new rail loop (4101) and movement of portions of two existing loops (4106 and 4107) would not impact existing topography.

Operation

Facility operation would not require further excavation of existing ground surfaces or other modifications to topography. Some soils in the area of the proposed Facility are susceptible to settlement from static loads, and without any improvements they could compress and sink slightly under the weight of overlying structures. The Applicant's proposed ground improvement techniques would mitigate these susceptible soils by strengthening them to reduce the risk of settlement.

Decommissioning

Facility decommissioning would not require significant modifications to site topography, and impacts would likely be negligible. Following removal of above- and belowground structures per the decommissioning plan, ground surfaces would be graded to match existing surrounding topography. Trenches, water quality vaults, and associated pump basins that were excavated in the unloading and office area and storage area (Areas 200 and 300) would be filled in and graded to match existing surrounding topography.

3.1.3.2 Rail Corridor

Geology, Soils, and Topography

Additional railcars would not be expected to have any impact on the bedrock geology along the rail corridor. As the rail corridor is already fully established and operational, no blasting or modification of bedrock would be necessary to accommodate one additional train per day. The potential for soil contamination from leaking railcars along the rail corridor is low. These types of small leaks are anticipated to stay within the railbed and would not impact soils beyond the immediate railbed area. The potential for such leaks would be mitigated by regular inspection of all railcar elements. No topography modification impacts would be anticipated along the rail corridor from the Proposed Action.

3.1.3.3 Vessel Corridor

Geology, Soils, and Topography

Due to the limited exposure of bedrock directly along the vessel route and the resistance of the bedrock to erosion, no impacts from vessel transport would be expected on the bedrock geology along the vessel route. Increased deep-draft vessel traffic has the potential to increase soil erosion caused by vessel wakes. The banks of the Columbia River generally consist of loose, unconsolidated soils and sedimentary deposits, and soil erosion would be limited to the lower approximately 33 miles of the river where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent. Wake effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The increase in deep-draft vessel traffic and associated increase in vessel wakes could have a minor impact to erosion, primarily in the Columbia River estuary. Impacts to soil erosion from increased vessel traffic would be negligible along marine coastlines outside of Washington. As the vessel route is restricted to river and ocean waters of sufficient depth, no impacts from vessel transport would be expected on topography of the vessel transportation route.

3.1.3.4 Potential Impacts Resulting From Geologic Hazards

Based on the discussion of geologic hazards presented in Section 3.1.2.4, potential impacts to the proposed Facility, to operations within the rail corridor, and to operations within the vessel corridor resulting from these geologic hazards have been assessed and are presented below.

Potential Impacts to the Proposed Facility

Earthquake Hazards

<u>Fault Rupture</u>

No known or suspected faults lie within or near the proposed Facility site and, therefore, no impacts to the proposed Facility would occur from fault rupture.

<u>Ground Motion/Shaking</u>

Prolonged earthquake ground shaking has the potential to damage buildings, pipelines, or storage tanks. Seismic design standards and building codes would be applied in the construction of Facility elements to reduce the likelihood of negative impacts from ground motion. Engineers use seismic design parameters to develop specific levels of structure performance during an earthquake. The performance levels range from prevention of collapse to protect human lives to designing structures that continue to function at a high level immediately following the earthquake. The Applicant has proposed to design Facility structures considering ground motion from earthquakes of three different magnitudes:

- **Operational Level Earthquake**—5.8 magnitude. The Applicant would design structures such that during a magnitude 5.8 earthquake, damaged structures may require only minor repairs for them to continue functioning.
- **Contingency Level Earthquake**—8.4 magnitude. In the event of a magnitude 8.4 earthquake, structures would be designed such that damage could render them temporarily nonfunctional, but substantial repairs could return the damaged structures to full functionality.
- **Design Earthquake**—9.0 magnitude. In the event of a magnitude 9.0 earthquake, structures would be designed to prevent collapse to reduce the possibility of injury, loss of life, and environmental damage (e.g., oil spills). In such a massive earthquake event, however, damage to some structures could be beyond reasonable levels of repair and some Facility elements may require replacement.

The potential for seismic ground motion to damage a given bulk storage tank depends on a number of factors, including the type and strength of seismic motions, ground/soil conditions, tank structure, and the amount and type of material in the tank at the time of the earthquake. A study commissioned by the US National Institute of Standards and Technology concluded that, in general, bulk storage tanks perform reasonably well in earthquakes, particularly tanks with diameter to height ratios of greater than two (Cooper 1997). The bulk storage tanks at the proposed Facility would have a diameter to height ratio of five. In accordance with the application of the currently adopted IBC, construction of new tanks is required to consider site-specific seismic loading. The Applicant has stated that the oil tanks in the storage area (Area 300) would be designed to the seismic provisions in Annex E of the twelfth edition of the API 650 standard, which is aligned with the ASCE 7-10 standard (BergerABAM 2014).

The upland aboveground facilities, other than the oil storage tanks, would meet the provisions of IBC 2012, which incorporates the ASCE 7-10 standard by reference. Marine terminal dock modifications in Area 400 would conform to the IBC 2012, as amended and adopted by the State of Washington and the City of Vancouver, with the exception of mooring and berthing design, structural load combinations, and seismic design. The seismic design of piers and wharves not accessible to the general public is beyond the scope of the ASCE 7-10 standard. The recently released ASCE 61-14 standard, Seismic Design of Piers and Wharves, would be used for the seismic design of such structures in the marine terminal (Area 400). If these design standards are implemented, the risk of severe structural damage or failure of Facility elements from facility shaking resulting from earthquake ground motion associated with a great earthquake on the CSZ or other lesser earthquakes from the CSZ or other faults would be minor. It is important to note, however, that the risk is never completely eliminated irrespective of design and construction used at a site.

Liquefaction

As stated previously, liquefiable[6] soils underlie certain Facility elements. Structures that may otherwise withstand ground movement could be damaged if underlying soils liquefy. Geotechnical assessments of the proposed Facility location (URS 2011a, GRI 2013, Hayward Baker 2014) have concluded that soils in portions of the site could experience liquefaction during an earthquake, resulting in significant dynamic settlement and lateral spreading deformations in some areas, especially near the riverbank. Ground settlement was estimated to be approximately 10 to 16 inches in the unloading and office area and the boiler building (Areas 200 and 600), 6 to 10 inches in the storage area (Area 300), 3 to 15 inches in the transfer pipelines (Area 500), and 12 to 24 inches in the marine terminal (Area 400) (GRI 2013). Such settlement has the potential to damage overlying structures, including buildings, pipelines, or storage

6 Soil liquefaction describes a phenomenon whereby a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition, causing it to behave like a liquid.

tanks. Estimates of lateral spread magnitudes at the shoreline for Terminal 5 may be up to approximately 12 feet at that site (URS 2011b), which could impact slope stability along the banks of the Columbia River.

Improving the condition of soils beneath critical areas and Facility elements at the site would reduce the risk of dynamic settlement and lateral displacement during an earthquake. Ground improvement would also reduce the seismic lateral load on the dock foundations and reduce the risk of soil and debris sliding into the Columbia River. Ground improvements would include a combination of driven piles, spread footings, soil mixing, jet grouting, wick drains, and vibroreplacement stone columns. These methods are described in Chapter 2.3.2.2.

EFSEC commissioned an independent analysis of the seismic hazards related to the proposed Project. The analysis confirmed that liquefaction was a concern given soils conditions underlying the proposed Facility site. The analysis used a maximum considered earthquake (MCE) of 8.9 magnitude resulting from a 2,475-year return period earthquake on the CSZ. The analysis determined that:

- The ground improvement procedures proposed by the Applicant would prevent damage to tank foundations in the event of an 8.9 magnitude at the storage area (Area 300).
- At the storage area (Area 300), no ground improvement is proposed for soils underlying the secondary containment berm. The stone columns under the foundations supporting the storage tanks do not extend to the berm. Therefore, potential exists for liquefaction and ground deformation under the secondary containment berm. Designing the berm to withstand ground motion/shaking is appropriate but needs to be combined with an assessment of required mitigation for potential liquefaction (i.e., ground improvements) beneath the berm.
- At the dock and adjacent transfer pipeline within the marine terminal (Area 400), the MCE could result in 7 to 14 feet of lateral spreading at the dock and at the proposed transfer pipeline near the shoreline. Additionally:
    - Some of the vibroreplacement stone columns the Applicant proposes in this area may not reach stable foundation soils at depth based on existing geotechnical data.
    - The ground improvement consisting of deep soil mixed panels supported by jet grout columns does not have a well-established performance record.
    - Potential sliding of portions of the shoreline embankment south of and downslope from the system of proposed ground improvements is not mitigated by these improvements and, if this sliding occurs, it could deform the dock or displace a moored vessel.
- In the transfer pipelines (Area 500), near the shoreline at the southern end of the transfer pipeline, existing data indicate that the depth to stable nonliquefiable soils ranges from 33 to 51 feet bgs. The current ground improvement design includes stone columns with depths of between 5 and 16 feet bgs, which would not reach the underlying stable soils.

Given the potential for soil liquefaction and lateral spreading described above, even with the implementation of the Applicant's proposed ground improvements, impacts from these earthquake hazards could range from moderate to major. Additional mitigation measures were identified during the independent analysis that would, if implemented, reduce the range of impacts. These mitigation measures are described in Section 3.1.5.

<u>Tsunamis and Seiches</u>

Large-scale tectonic tsunamis generated in the open ocean are not considered an impact at the Port due to the 106-mile distance between the Port and the Pacific Ocean.

Landslide Hazards

Landslides are not considered an impact at the proposed Facility. Topography at the Port is relatively flat, with no steep slopes or evidence of historic landslides.

Volcanic Hazards

Impacts to the proposed Facility from volcanic activity would likely be negligible, due to the large distance between local volcanoes and the proposed Facility site. However, in the event of a massive eruption, ashfall could have a negligible to minor impact on the Port area. A massive volcanic eruption combined with certain wind conditions could lead to substantial ashfall at the proposed Facility site. Hazards from ashfall include accumulation of ash on structures; clogging of electronics, machinery, and filters; suspension of abrasive fine particles in air and water; and accumulation of ash on transportation routes and vegetation. In the event of a large eruption, implementation of onsite emergency plans would significantly reduce the impacts of ashfall or lahars.

Rail Corridor

Earthquake Hazards

Seismic hazard impacts along the rail corridor could vary from negligible to moderate. The potential for seismic activity capable of disrupting rail transportation is particularly high within Washington. Impact includes potential derailment associated with earthquake hazards. A detailed description of earthquake hazards along the rail corridor in Washington is provided in Appendix C. BNSF policy requires that rail operations halt all traffic following a seismic event of magnitude 5.5 or higher in those areas where impacts could occur. For UP, all rail traffic within a 50-mile radius of the epicenter is directed to stop in the event of an earthquake of 5 to 7 on the Richter scale (Sirotek 2002). Operations would not commence until inspections of the impacted areas were completed.

Fault rupture hazard may exist in the vicinity of the Wallula Fault south of Kennewick. A rupture of this fault could lead to track damage and minor short-term impact to the rail system. The likelihood of a derailment from an event on this fault is considered low. Ground motion/shaking associated with earthquake activity in the region could cause some minor damage to rail facilities. Soil liquefaction along the rail corridor could be associated with some minor landslides.

Large-scale earthquake-induced tsunamis are not considered an impact to rail transportation. These events occur in marine environments and would, therefore, not be encountered along the rail corridor. Smaller-scale landslide-generated waves could be an impact to rail transportation in areas where the rail corridor parallels a waterbody beneath a steep slope. The probability of a landslide-generated wave impacting the rail corridor is low, but in the rare circumstance in which such waves inundated rail tracks, impacts could be moderate.

Landslide Hazards

Landslides pose a minor to moderate potential impact to rail transportation. The rail corridor would pass through various regions with steep slopes where potential exists for landsides to occur. The USGS and WDNR have identified areas of elevated landslide susceptibility and incidence along the rail corridor. Within Washington, the greatest frequency of occurrence for mapped landslide deposits is in the Cascade Mountain Range (see Appendix P.2, Mapbook K2A). Some areas along the Columbia River Gorge are also at an elevated risk for landslides. In the eastern portion of the corridor, the greatest potential for landslide hazards has been identified within the Missouri River Valley (see Appendix P.2, Mapbook K2B).

A landslide could result in a train car derailment if the active slide were to strike the train, or if slide debris covered or damaged the tracks and a train was unable to stop prior to impacting the debris. BNSF identified locations where landslide susceptibility is high, and these sites are monitored by rail operators to reduce the potential for injuries and damage to rail equipment. BNSF has installed slide fences, catchment walls, and widened ditches to contain landslide debris and stabilize slopes. BNSF routinely inspects and maintains the slopes, ditches, retaining structures, and tracks to minimize impacts to railroad operations when landslides occur. Inspection and monitoring of the rail corridor in known slide locations is heightened during the rainy season. When a landslide occurs that blocks one or more tracks, BNSF imposes automatic moratoria on rail service through the impacted segment of the corridor until cleanup/repairs can be completed. In areas where landslides have resulted in service disruptions and other impacts, BNSF would initiate a program to mitigate issues.

Volcanic Hazards

Mt. Hood, Mt. Adams, and Mt. St. Helens are at approximate distances of 20, 30, and 40 miles from the closest point along the rail corridor, respectively. Depending on the size of an eruption, quantity of ash released, and the prevailing wind direction at the time of eruption, ashfall from these or other volcanoes could impact the rail corridor. The impact of ashfall could vary from negligible (a light dusting of ash) to moderate (burial of rail infrastructure under ash). Lahars and/or debris flows could travel down river valleys that extend to the railroad corridor along the Columbia River. The impact of lahars and/or debris flows could vary from minor (light deposits of mud) to major (derailments, flooding/burial/damage of rail infrastructure). The Cascades Volcano Observatory/USGS maintains an extensive seismic network on regional volcanoes. In the event of an impending eruption, widespread warning would be given throughout the region, initiating measures to protect personnel and equipment along the rail corridor.

Vessel Corridor

Earthquake Hazards

Seismic hazards along the vessel corridor occur near the Columbia River mouth and offshore along the marine transportation route. These hazards are associated with potential tsunami and seiche waves generated from either the CSZ or other Pacific Ocean subduction zones. Impacts from these waves to vessels in the nearshore shallow-water environment could be major. Marine vessels on the open ocean are not likely to be impacted by earthquake-generated tsunami waves as these waves typically exhibit lower amplitudes in the open ocean due to the water depth. Tsunami waves in the open ocean are typically less than a foot in height and pass under marine vessels unnoticed. As these waves approach shallow water, however, wave amplitudes increase substantially and the rise in the seafloor topography causes the waves to increase in height. Earthquake-generated submarine landslides could also create tsunami waves that could impact vessels in nearshore environments. Detailed analysis of the effects of a tsunami has been conducted at the Columbia River mouth. Tsunamis generated from a CSZ earthquake could result in wave heights up to 18 feet at Astoria. Tsunami energy cannot be sustained in the river, however, due to the complex nature of tides. Thus, 18 miles upriver, predicted wave heights dissipate rapidly to less than 5 feet (Yeh et al. 2012). In the event of a tsunami, a vessel could be inundated, grounded on the river bottom, pushed out of the navigation channel, or capsized from the wave. The probability of this type of incident is low, but it could have major impacts if it were to occur. National Oceanic and Atmospheric Administration (NOAA) operates the Pacific Tsunami Warning System, which provides warnings for the Pacific Basin including United States and other nations around the Pacific Rim. The warning system uses seismic data, tide gauges, and buoys to predict, detect, and issue warnings for seismic events. In the event of an earthquake capable of generating tsunamis, NOAA issues warnings to all potentially impacted vessels. Vessels in vulnerable nearshore environments would be encouraged to set a course for deeper water.

Vessels along the length of the Columbia River could be impacted by smaller-scale, locally generated tsunami or seiche waves. Impacts from a local, small-scale seiche wave would likely be negligible to minor.

Landslide Hazards

Along the Columbia River, landslides could cause seiches, and these seiches could impact marine vessels within the river. Along marine routes, landslides along shorelines would not be expected to impact vessel transportation. Submarine landslides could create locally generated tsunami waves capable of impacting vessels close to shore.

Volcanic Hazards

Likelihood of volcanic ashfall affecting vessels in the vessel corridor is low. In the event of a massive eruption, however, vessels could experience moderate impacts. Along the Columbia River, distances between the Cascade volcanoes (Mt. Rainier, Mt. Adams, Mt. St. Helens, and Mt Hood) and the vessel corridor are great, and any ashfall would likely disperse before depositing in high quantities on vessels. Additionally, the dominant wind direction in the area is to the east, so most volcanic ash would likely blow away from the vessel corridor, not toward it.

In oceanic areas of the vessel corridor, vessels could also be subject to ashfall. Off the California, Oregon, Washington, and British Columbia coasts, distances between volcanoes and the vessel routes are large enough that high ash accumulation on vessels is very unlikely. Vessels traveling near Alaska and Hawaii could be close enough to active volcanoes that ash accumulation on the vessels could occur. In the unlikely event that ashfall on a vessel were high, impacts could be minor to moderate. The ash could damage vessel equipment and require emergency repairs to allow for continued navigation.

Impacts from volcanic lahars are considered negligible. A lahar from an eruption at Mt. Hood could increase the water and sediment level in the Columbia River. However, it is unlikely that the levels would rise enough to be a hazard to vessels. If evidence monitored at the Cascades Volcano Observatory suggests an impending eruption could produce significant ashfall or lahars, widespread warning would be given throughout the region, allowing for implementation of measures to protect personnel and equipment along the vessel corridor.

3.1.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant’s request to construct and operate the proposed Project at the Port, and the following impacts to earth resources from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to earth resources beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. These facilities would likely involve construction activities resulting in similar types of impacts to earth resources as described for the proposed Facility, including a minor, temporary increase in soil erosion potential and minor modifications to topography. A different facility would be subject to the same geologic hazards, but in the event that no hazardous material is stored in large quantities at the Port, impacts from seismic activity would be reduced.

3.1.5 Mitigation Measures

Design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to earth resources and in the analysis of geologic hazards that could affect the proposed Project. EFSEC has identified the following additional mitigation measures to reduce impacts from construction methods and seismic hazards associated with the proposed ground improvements:

- Reassess the required depth of penetration of stone columns in the marine terminal (Area 400) and the western portion of the transfer pipelines (Area 500) near the Columbia River shoreline along the transfer pipeline and at the dock to secure the stone columns in either the nonliquefiable dense sand unit immediately overlying the Troutdale gravel or in the Troutdale gravel itself to reduce the risk of damage during seismic ground motion/shaking. If the depth to the nonliquefiable dense sand unit is greater than the currently proposed depth, the installation depth should be increased accordingly. Additional impacts associated with this mitigation would include more disturbance of existing site soils and some additional construction activity. These additional impacts would be negligible.
- Install stone column ground improvements beneath the entire secondary containment berm in the storage area (Area 300) to ensure berm stability in the event of earthquake induced liquefaction. While the Applicant has committed to a seismic stability analysis of the berms in accordance with WAC requirements, they only require designing the containment structure to withstand seismic forces and constructing with sound engineering practice. Designing the berm to withstand ground motion/shaking is appropriate but needs to be combined with an assessment of potential liquefaction beneath the berm, and the requirement to extend the ground improvements deeper into the ground. Additional impacts associated with this mitigation would include more disturbance of existing site soils and some additional construction activity. These additional impacts would be negligible.
- Conduct more thorough numerical modeling/analyses (e.g., FLAC, PLAXIS) of the ground improvement system in the marine terminal (Area 400) to verify the anticipated performance of the deep soil mix panels supported on top of the jet grout columns. The outcome of the modeling is expected to include revised numbers, dimensions, and geometry of ground improvement elements to demonstrate expected control of ground displacements and lower potential for pipeline damage. If the numerical modeling results do not verify the anticipated performance, redesign the ground improvement system to achieve the anticipated results.
- Confirm that the design of the transfer pipelines (Area 500) has sufficient strength and flexibility to withstand earthquake-generated ground deformations that could impact the dock and moored vessels during seismic events. If existing evidence is unavailable or does not support the required strength and flexibility of the transfer pipeline, redesign these Project elements to achieve that result. Alternatively, extend ground improvements into the soil forming the sloping embankment beneath the dock structure. Any ground improvements or dock modifications occurring below the OHWM would require consultation with the US Army Corps of Engineers (USACE) and other relevant state agencies to assess potential impacts to terrestrial and aquatic species and habitats and water quality. Conduct in situ geotechnical testing (e.g., CPT or SPT) during the installation of ground improvements to ensure that the soils have been sufficiently improved to achieve expected reduction in liquefaction potential. If the testing determines that the expected level of ground improvement has not been achieved, continue ground improvement activity until the expected level of improvement is achieved.
- Install sediment control barriers (silt fencing with filtration fabric keyed in at ground surface; possibly straw wattles) at the top of the embankment to prevent flow of silt-laden water from stone column installation from entering the Columbia River. Monitor the water on the river side of the sediment control barrier to ensure the expected level of water quality is maintained. If the water quality on the river side of the barrier is unacceptable, implement additional sediment control measures until the desired level is achieved.

- Install monitoring wells downslope from the stone column and jet grout column installation areas to monitor water quality during the installation of these improvements. In the event of unacceptably high pH levels and/or sulphate levels during ground improvements, install additional sheet pile barriers to prevent contaminated water from entering the Columbia River, or halt jet grouting until a modified approach with BMPs can be approved by EFSEC. Additional impacts associated with this mitigation would include more disturbance of existing site soils and some additional construction activity. These additional impacts would be negligible to minor.
- Check potential deformation of the ground surface along the river embankment during installation of ground improvements, utilizing survey measurements of surface markers, or more sophisticated instrumentation, as needed.

Section 3.6.5 includes mitigation measures to reduce the potential for wake stranding of aquatic species which would also reduce the rate of erosion from wake-induced effects descried herein.

3.1.6 Significant Unavoidable Adverse Impacts

The construction, normal operation and maintenance, and decommissioning of the proposed Facility would not result in any significant unavoidable adverse impacts on earth resources. As the Port has been an industrial site for over a century, additional use of the Port facilities would have negligible additional impacts. Additionally, impacts to the rail and vessel corridors would likely be negligible to minor for normal operations, and no significant unavoidable adverse impacts would occur along the rail or vessel corridors.

Small-scale geologic hazards would likely have minor impacts to the proposed Facility and along the rail and vessel corridors. If an MCE earthquake (or larger) were to occur along the CSZ, moderate to major unavoidable impacts could result from the liquefaction of susceptible soils underlying elements of the proposed Facility. However, key proposed Facility elements (e.g., tank farm, transfer pipelines) would be constructed with a ground improvement program that would lower the risk of structural damage from soil liquefaction. Implementation of the additional mitigation measures would further reduce the risk of structural damage. It is important to note, however, that the risk is never completely eliminated irrespective of design and construction used at a site.

A large earthquake could cause moderate to major disruptions to rail transportation in areas along the rail corridor where seismic ground motions induce soil liquefaction or slope instability.

Vessels in deep water along the open ocean vessel corridor are not likely to be impacted by tsunamis resulting from subsea fault ruptures or large-scale landslides. However, in nearshore environments or near river mouths, such the Lower Columbia River, impacts to vessels from tsunamis could range from moderate to major.

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3.2 AIR QUALITY

This section addresses the air quality impacts for construction, operations and maintenance, and decommissioning of the proposed Facility (direct impacts), as well as the air quality impacts from rail and vessel operations associated with the proposed Facility (indirect impacts). The effect of air emissions on global climate change is also discussed. For better understanding of this subject, air terminologies and descriptors are included below. A brief description of the methods used to assess air quality impacts is included, as well as actions that could be taken for mitigation.

3.2.1 Air Quality Terminology and Descriptors

Ambient Air Quality Standards. Air quality is defined by the ambient (i.e., surrounding) air concentrations of specific pollutants determined by the US Environmental Protection Agency (EPA) to be of concern to the health and welfare of the general public and the environment, and that are widespread across the United States. These primary pollutants of concern, called “criteria pollutants,” include carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, suspended particulate matter (PM) less than or equal to 10 microns in diameter (PM_{10}), fine PM less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead.

These pollutants are subject to both primary and secondary National Ambient Air Quality Standards (NAAQS). Primary standards provide public health protection, including protecting the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The State of Washington has also adopted Ambient Air Quality Standards (WAAQS) for certain pollutants and where both NAAQS and WAAQS apply, the more stringent standards prevail. Appendix A for further information on federal, state, and local air quality regulatory requirements and standards.

Air Quality Attainment Status. The EPA determines air quality attainment status based on whether the air quality in the area meets (attains) the NAAQS. Areas that violate NAAQS are designated as “nonattainment areas” for the relevant pollutant. Areas with insufficient data are designated as “attainment/unclassified areas” and are treated as “attainment areas” under the Clean Air Act. Areas that were previously designated nonattainment and have demonstrated compliance with the relevant NAAQS are designated “maintenance areas” for 20 years after the effective date of attainment, assuming they remain in compliance with the standard.

Air Quality Conformity Rules. Special air quality “conformity” rules apply in areas that are designated as nonattainment or maintenance for one or more air pollutants,[1] as described in more detail in Appendix A.

Air Toxics. Hazardous air pollutants (HAPs) and toxic air pollutants (TAPs) are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects, and are collectively known as Air Toxics. Diesel particulate matter (DPM) is one of the most common Air Toxics found in ambient air and results from the combustion of diesel fuel, either in stationary sources or mobile sources.

1 These rules, which are intended to prevent new air quality problems or delay achieving attainment, apply in the study area for the Proposed Facility site because it is considered “maintenance” for CO.

Greenhouse Gases. GHGs are gases that trap heat in the atmosphere and include carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases. Because CO_2 is the reference gas for climate change, measures of non-CO_2 GHGs are converted into carbon dioxide equivalent (CO_2e). CO_2e refers to the metric tons of CO_2 emissions with the same global warming potential as 1 metric ton of another GHG. The global warming potentials are calculated and are a measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to CO_2 (EPA 2013a). As an example, methane, which is a common GHG, is widely represented as having a 100-year global warming potential of 25.

3.2.2 Methods of Analysis

The study area for analyzing air quality impacts from the proposed Facility is the Portland Interstate Air Quality Control Region (AQCR) (Oregon-Washington), which includes the counties of Clark, Cowlitz, Lewis, Skamania, and Wahkiakum in Washington, and the counties of Benton, Clackamas, Columbia, Lane, Linn, Marion, Multnomah, Polk, Washington, and Yamhill in Oregon. For purposes of identification, the Portland Interstate AQCR is referred to by Washington state authorities as the Portland (Oregon)-Southwest Washington Interstate AQCR.

The analysis of impacts to air quality considered impacts from Facility construction and operation, including emissions, criteria air pollutant dispersion, and odor release. The production of emissions during rail-caused vehicle delays and vessel transport were also estimated. Greenhouse gas emissions were evaluated for all processes associated with the proposed Facility. The greenhouse effect and its impacts on climate change were also reviewed.

To assess air quality impacts from trains and vessels associated with the proposed Facility, the following activities and associated study areas were included:

- Trains operating at the proposed Facility while waiting to unload, during unloading, and while leaving
- Trains transiting within Washington along the inbound Columbia River Alignment and outbound Central Return - Stampede Pass Alignment
- Vessels transiting within Washington’s 3-nmi boundary from the mouth of the Columbia River to the proposed Facility marine terminal
- Tugs assisting tankers during docking and undocking at the proposed Facility marine terminal

The air quality impacts analysis included: (1) emission inventory estimates of all criteria pollutant and GHG emissions related to construction of the proposed Facility; (2) emission inventory estimates of annual total criteria pollutant, HAPs, and GHG emissions associated with stationary and mobile source operations of the proposed Facility at full capacity (including rail and vessel operations); and (3) dispersion modeling at the proposed Facility to estimate operational ambient air quality.

An emissions inventory and dispersion modeling assessment for operation of the proposed Facility’s stationary sources was carried out by the Applicant, and the methods used are documented in the Revised Air Permit Application (Vancouver Energy 2014). The stationary sources include the following:

- Three natural gas–fired boilers used during product unloading
- Eight marine vapor combustion units (MVCUs) used to combust vapors displaced during vessel loading (operating individually or in tandem to balance the load based on the variable capacity of vessels)

- Product-handling component (e.g., valve seals and pressure-relief valves) fugitive emissions
- Crude oil storage tank fugitive emissions
- Emergency fire pump engines fueled with diesel
- Emergency portable diesel-powered generators

For this Draft EIS, these stationary sources were considered in combination with mobile source emissions from vessels and trains associated with operation of the proposed Facility.

Air quality impacts were reviewed in light of federal, state, and local air pollution standards and regulatory requirements, where applicable. Where no regulatory standards could be applied, as is the case with mobile sources of air pollution, comparative thresholds were used (i.e., comparison to stationary source regulatory thresholds or statewide emissions inventories). The identification of air quality impacts also took into consideration other factors such as the uniqueness of a particular location and existing environmental conditions.

3.2.2.1 *Emissions Inventories*

The emissions inventories for stationary and mobile sources were developed using a variety of standardized references and tools including: EPA's AP-42, which provides emission factors for a wide variety of emission sources; Tanks 4.09d, which is an EPA model specifically designed to provide emission information for breathing[2] and working[3] losses from storage tanks; manufacturer-supplied data; and other reference materials that are described in the Revised Air Permit Application; Appendix F (Air Quality Technical Report) (ENVIRON 2014); and Appendix G (Air Emission Calculations).

All criteria pollutants and GHG emissions from the proposed Facility were quantified. A large portion of emissions associated with the proposed Facility would be generated from the combustion of fossil fuels by equipment and vehicles, the primary pollutants from which are nitrogen oxide (NOx), total organic compounds, CO, and PM, which include both visible (smoke) and nonvisible emissions (EPA 1996a).

To assess Air Toxic emissions during operations, formaldehyde was quantified for operational mobile sources because it is the predominant organic HAP in diesel fuel combustion products. The operation of diesel-powered construction equipment would be mobile and intermittent over the course of the construction period and would produce minimal ambient impacts to HAPs in a localized area. Instead, a qualitative assessment of DPM emissions was carried out because DPM emissions results from the combustion of diesel fuel in mobile sources.

3.2.2.2 *Dispersion Modeling*

Operational stationary source emissions and onsite and near-site mobile source emissions for CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, and DPM were evaluated by the Applicant using an EPA-approved dispersion model, AERMOD (ENVIRON 2014). Stationary source emissions for eight TAPs were also evaluated using AERMOD (Vancouver Energy 2014). AERMOD is an approved EPA modeling tool preferred for near-field simulation of industrial stack releases (i.e., a simulation of the dispersion of air pollutants in the surrounding area of an emissions source). The AERMOD model includes preparation of a meteorological data set (e.g., wind, temperature) along with surface roughness estimates (texture of the surrounding area) based on nearby land uses. These data are used in conjunction with detailed estimates of emissions that

2 Vapors that escape a closed system.

3 Vapors that are generated and released while a liquid material is being pumped into or out of a tank.

are both temporally and spatially distributed to simulate operation of the sources being considered. Pollutant estimates from proposed Facility stationary sources were calculated at simulated locations referred to as "model receptors." This type of modeling estimates the contributions from each onsite source to the total air pollution generated at a site. Using a grid, the model generates data on pollution concentrations at the various receptor locations. The 10 × 10 kilometer (6.2 × 6.2 mile) modeling domain (study area) and the variously spaced modeling receptor grids used in the air quality impact assessment are shown on Figure 3.2-1.

The AERMOD assessments for compliance with 24-hour and annual average NAAQS were based on estimated daily and annual emission rates, respectively. However, the modeling for the short-term 1-hour and 3-hour NAAQS very conservatively assumed maximum hourly emissions occurred during every hour of every day of the 5-year meteorological data set. This sort of screening-level analysis is conducted as a first (and sometimes only) step because failure to comply with the NAAQS under these assumptions leads to more refined and realistic modeling. In the event that NAAQS during this step are not exceeded by project emissions, the analysis is complete. However, in this case, because the initial screening-level dispersion modeling for 1-hour NO_2 indicated that emissions from onsite locomotives could exceed the NAAQS, more refined modeling was conducted. These additional analyses for 1-hour NO_2 were performed based on the following:

Seasonal/Hourly Background Concentrations. The screening-level AERMOD modeling analysis assumed a constant 68 micrograms per cubic meter ($\mu g/m^3$) background concentration for NO_2, rather than using more realistic background concentrations that change both hourly and seasonally. The more refined modeling assessment applied hourly background concentrations that varied by season and were based on EPA guidance (EPA 2011).

Monte Carlo Post-Processing Simulations. The initial AERMOD assessment of 1-hour NO_2 concentrations from trains traveling in and near the proposed Facility site was based on a worst-case situation in which three trains would be unloading simultaneously with the front-end locomotives of two trains essentially side-by-side near the eastern end of the unloading area and the front locomotive of the third train 1,800 feet farther along the line. This situation in reality could only occur for approximately 1 hour per day, and so the screening assumption greatly overstated emissions near the northern proposed Facility property line. For this reason, modeling data were further analyzed using a Monte Carlo simulation to create a more realistic worst-case scenario of onsite train emissions.

A Monte Carlo simulation performs risk analysis by building models of possible results by substituting a range of values—a probability distribution—for any factor that has inherent uncertainty. It then calculates results several times, each time using a different set of random values from the probability functions. Depending on the number of uncertainties and the ranges specified for them, a Monte Carlo simulation could involve thousands or tens of thousands of recalculations before it is complete. The simulation produces distributions of possible outcome values. For this analysis of NO_2 emissions from trains at the proposed Facility, a Monte Carlo simulation was performed based on randomly selecting a 1-hour period each day when this worst-case situation would occur, and then analyzing this information statistically.

The Monte Carlo simulations involved post-processing hourly modeling results for each day of the 5 years analyzed to randomly select hours during which the worst-case train activities would occur. Data from the hour selected for each day were considered for each modeling receptor. This process was repeated 1,000 times for each year. Results of this selection process were then used to compute the median hourly NO_2 concentrations for comparison with the 1-hour ambient air quality standard. This analytical process was consistent with the approach developed by Washington State Department of Ecology (Ecology) for addressing compliance assessments of intermittent or randomly occurring emission sources (Ecology 2011a).

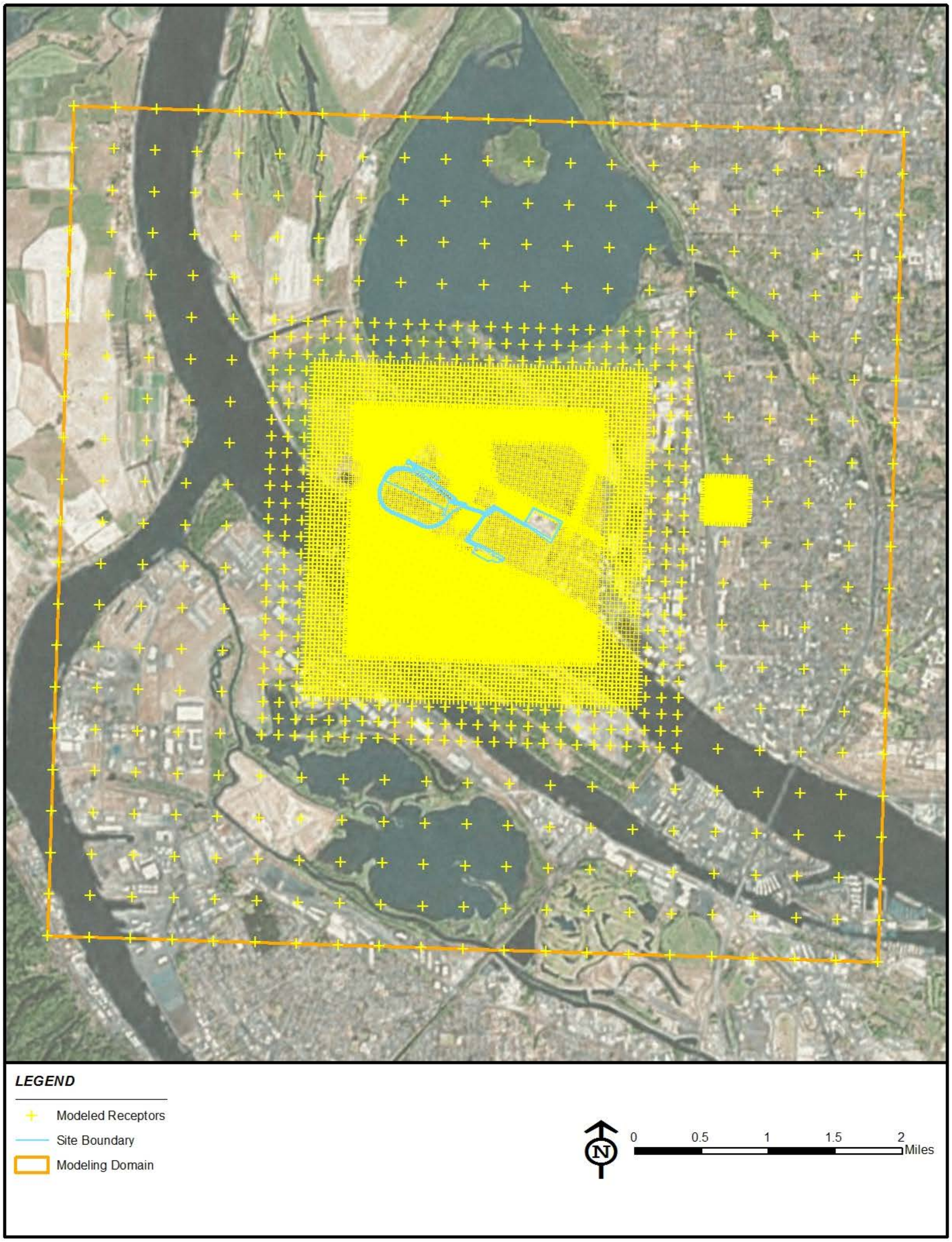

Figure 3.2-1. AERMOD Modeling Domain

Source: ENVIRON 2014

3.2.3 Affected Environment

3.2.3.1 Proposed Facility

Climate and Meteorology

Air quality is substantially influenced by climate and meteorological conditions, so prevalent weather patterns are a major factor in both short- and long-term air quality conditions. Regional geography affects climate in the proposed Facility study area. The combination of mountains and water creates a regional meteorology unique to the Pacific Northwest. The climate in the study area is predominantly temperate, characterized by wet, mild winters and dry, warm summers. The climate is influenced by the relative proximity of the Pacific Ocean and the Cascade and Coast ranges of Oregon and Washington. Annual average precipitation measured at the Vancouver 4 NNE agricultural meteorological station reaches 40 inches, with most precipitation occurring during the winter months and an average snowfall of 6.5 inches (Western Regional Climate Center 2015).

Wind direction and wind speed are complicated by geography, so it is more difficult to represent predominant winds using more distant climatological data. A 5-year data set was created for purposes of dispersion modeling using meteorological data from Vancouver Airport/Pearson Airfield, located on the northern bank of the Columbia River about 4 miles east of the proposed Facility site. This monitoring location was the nearest to the site with complete and quality-assured data suitable for use with air quality modeling. The data indicate that the winds are predominantly from the northwest and east-southeast directions; the average wind speed during the 5-year meteorological period was 2.3 meters per second (5.1 miles per hour [mph]), and calm conditions occurred less than 2 percent of the time (ENVIRON 2014).

Existing Air Quality Conditions

National and Washington air quality standards are defined in Table 3.2-1. Where both NAAQS and WAAQS apply, the most stringent standards prevail.

The proposed Facility would be located in a region considered to be in attainment for all criteria pollutants. However, the region has been in nonattainment in the past and is subject to regional air quality maintenance plans to ensure continued compliance. Specifically, Vancouver has been designated as a CO maintenance area since 1996 (EPA 1996b). Consequently, the proposed Facility would require a General Conformity applicability analysis.

Table 3.2-1. National and Washington Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards		Washington Standards
		Primary	Secondary	
PM_{10}	24-hour	150 µg/m^3	150 µg/m^3	Same as NAAQS
$PM_{2.5}$	Annual (Arithmetic Mean)	12 µg/m^3	15 µg/m^3	Same as NAAQS
	24-hour	35 µg/m^3		Same as NAAQS
SO_2	Annual (Arithmetic Mean)	0.030 ppm	--	0.02 ppm
	24-hour	0.14 ppm	--	Same as NAAQS
	3-hour	--	0.5 ppm	Same as NAAQS
	1-hour	75 ppb	--	Same as NAAQS
NO_2	Annual	--	53 ppb	Same as NAAQS
	1-hour	100 ppb	--	Same as NAAQS

Table 3.2-1. National and Washington Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards		Washington Standards
		Primary	Secondary	
Ozone	8-hour	0.075 ppm	0.075 ppm	Same as NAAQS
CO	8-hour	9 ppm	--	Same as NAAQS
	1-hour	35 ppm	--	Same as NAAQS
Lead	Rolling 3-month average	0.15 µg/m³	0.15 µg/m³	Same as NAAQS

Sources: EPA 2014a, Ecology 2013

CO = carbon monoxide, NO_2 = nitrogen dioxide, µg/m³ = microgram(s) per cubic meter, NAAQS = National Ambient Air Quality Standards, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, ppb = part(s) per billion, ppm = part(s) per million, SO_2 = sulfur dioxide

Table 3.2-2 summarizes concentrations of criteria pollutants measured at locations in the general vicinity of the proposed Facility site, including locations in Oregon, for pollutants that are not measured at nearby locations in Washington, using best available data. The data show that existing air quality is in compliance with the applicable ambient standards.

Table 3.2-2. Summary of Measured Ambient Air Pollutant Concentrations

Pollutant	Monitoring Location	Average Period	Measured Concentration	Year	Applicable Ambient Standard
CO	SE Lafayette, OR	1-hour	3.7 ppm	2012	35 ppm
		8-hour	2.3 ppm	2012	9 ppm
NO_2	SE Lafayette, OR	1-hour	36 ppb (98th percentile)	2012	100 ppb
Ozone	Sauvie Island, OR	1-hour	0.064 ppm (4th high)	2012	0.12 ppm
		8-hour	0.053 ppm (4th high)	2012	0.075 ppm
$PM_{2.5}$	Fourth Plain Boulevard East, WA	24-hour	21 µg/m³ (98th percentile)	2012	35 µg/m³
		Annual	6.9 µg/m³ (weighted mean)	2012	12 µg/m³
PM_{10}	N. Roselawn Emerson Playfield, OR	24-hour	36 µg/m³ (first max)	2012	150 µg/m³
SO_2	SE Lafayette, OR	1-hour	5 ppb (99th percentile)	2012	75 ppb
		24-hour	2 ppb (99th percentile)	2012	140 ppb

Source: EPA 2014b

CO = carbon monoxide, NO_2 = nitrogen dioxide, µg/m³ = microgram(s) per cubic meter, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, ppb = part(s) per billion, ppm = part(s) per million, SO_2 = sulfur dioxide

Greenhouse Gases and Global Climate Change

Climate change is the general term used to describe the phenomenon of natural and human-caused effects on the atmosphere that cause changes in long-term meteorological patterns due to global warming and other factors. Due to the importance of the greenhouse effect and related atmospheric warming to climate change, the gases that affect such warming are called greenhouse gases or GHGs.

Climate change may already be having a number of potentially adverse effects in the Pacific Northwest, including the following documented and suspected impacts (Mellilo et al. 2014):

- Changes in streamflow timing related to changing snowmelt have been observed and are expected to continue, reducing the supply of water for many competing demands and causing far-reaching ecological and socioeconomic consequences.
- In the coastal zone, the effects of sea-level rise, erosion, inundation, threats to infrastructure and habitat, and increasing ocean acidity collectively pose a major threat to the region.
- The combined impacts of increasing wildfire, insect outbreaks, and tree diseases are already causing widespread tree die-off and are virtually certain to cause additional forest mortality by 2040, resulting in long-term transformation of forest landscapes.
- While the agriculture sector's technical ability to adapt to changing conditions can offset some adverse impacts of a changing climate, critical concerns for agriculture remain with respect to costs of adaptation, development of more climate-resilient technologies and management, and availability and timing of water.

Transportation is a significant source of GHG emissions, primarily through the burning of gasoline and diesel fuels. The 2011 emissions estimates for Washington suggest transportation accounted for about 45 percent of statewide GHG emissions (i.e., 41.9 out of 91.7 million metric tons), in part because emissions in other sectors are reduced as the state relies heavily on hydropower for electricity, unlike other states that rely more heavily on fossil fuels (e.g., coal, petroleum, and natural gas) to generate electricity. The next largest contributors to total gross GHG emissions in Washington were about 20 percent each from fossil fuel combustion in the residential, commercial, and industrial sectors, and in electricity generation (Ecology 2014a).

3.2.3.2 *Rail Corridor*

Delivery of crude oil by rail to the proposed Facility would result in an average of four inbound and four outbound train trips per day during full Facility operation. These trains would operate along existing rail lines between the loading facilities where they originate and the proposed Facility. Integration of the trains delivering crude oil to the proposed Facility into the normal ebb and flow of train volume on the Class 1 rail system does not involve any construction or modification of the rail system.

The rail routes through Washington would pass through several air quality maintenance areas (Figure 3.2-2). All such areas (Table 3.2-3) are subject to air quality control plans to ensure the area continues to meet the respective ambient air quality standards. Washington's State Implementation Plan (SIP) includes emission budgets and addresses air pollution affecting any given area. Land uses along the Washington rail routes vary from densely urban to undeveloped rural areas and from mountains to valleys (i.e., the rail route does not pass through any Class I Wilderness Areas within Washington). Meteorological conditions, including periods of prolonged wintertime stagnation, vary substantially as does the presence or absence of industrial, transportation, and area sources (e.g., residential wood burning) of air pollutants.

Overall, a 2011 Ecology emissions inventory indicates railroad locomotives represent a relatively small amount of total statewide emissions, contributing about 5 percent of the statewide NOx emissions compared with 57 percent for onroad mobiles sources, and less than 1 percent of the $PM_{2.5}$ emissions compared with about 23 percent for residential wood burning (Ecology 2014b). In Clark County in 2011, railroad locomotives contributed about 7 percent of the NOx emissions compared with 66 percent for onroad mobiles sources, and about 1 percent of the $PM_{2.5}$ emissions compared with 46 percent for residential wood burning (Ecology 2014b).

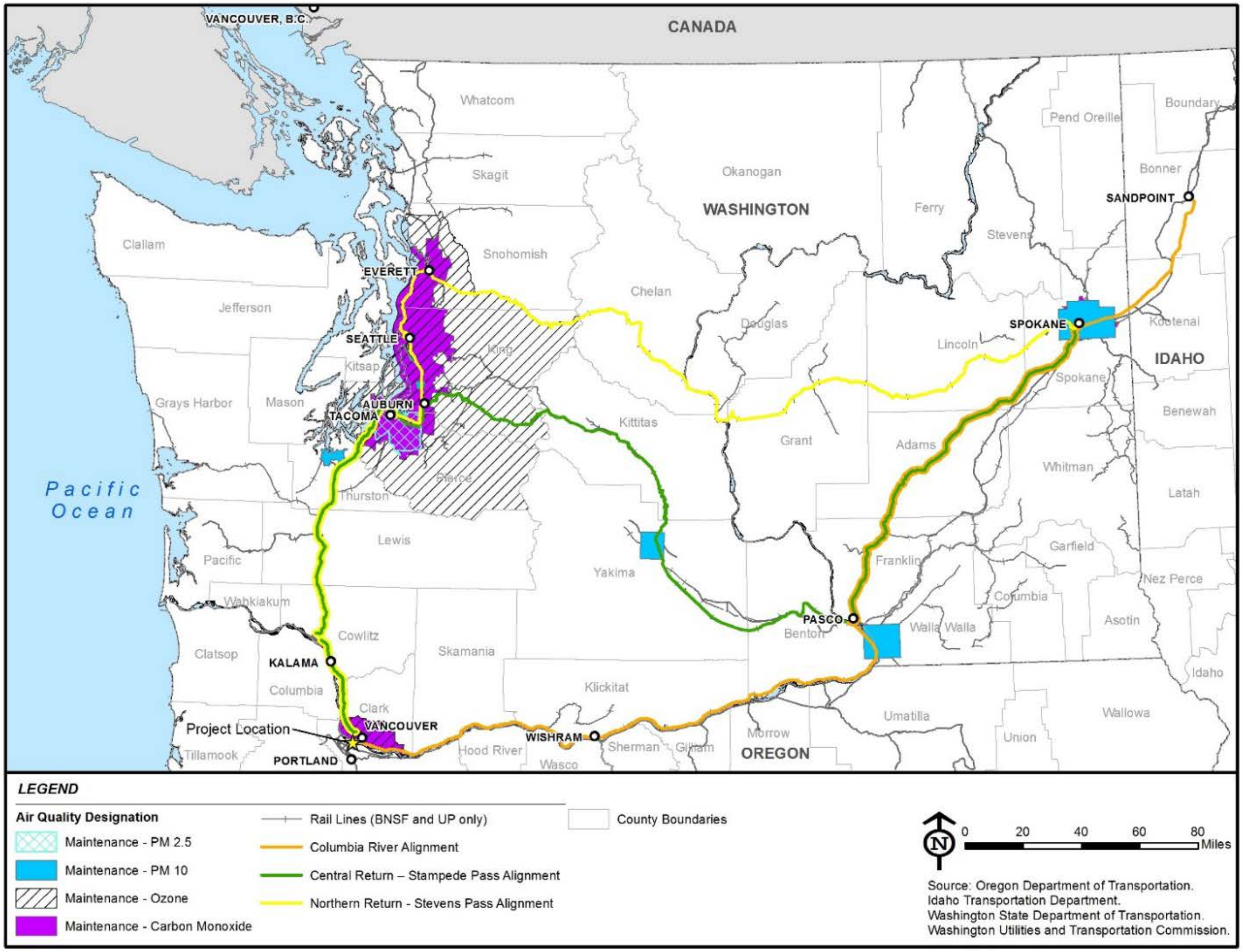

Figure 3.2-2. Air Quality Maintenance Areas in Washington

Sources: BergerABAM 2014, Ecology 2015

Outside of Washington, the rail route would pass through several air quality nonattainment and maintenance areas, including the Sandpoint PM_{10} nonattainment area in Idaho, the Whitefish, Columbia Falls, and Libby PM_{10} nonattainment areas in Montana, and the Libby $PM_{2.5}$ nonattainment area in Montana. Overall, the route would pass through a multitude of land uses, topographies, and meteorological climates that would affect air quality. The rail route does not pass through any Class I Wilderness Areas outside of Washington but skirts the Cabinet Mountains Wilderness Area and Glacier National Park in Montana.

Table 3.2-3. Air Quality Maintenance Areas within Washington

NAAQS Averaging Period Concentration	Effective Date Nonattainment Designation	Effective Date Redesignation to Attainment	Affected Counties and Cities
Maintenance Areas			
Ozone 1-hour 0.12 ppm	1/6/1992	6/15/2005	Pierce
			Most of King
			Part of Snohomish
	11/15/1990	6/15/2005	Portland-Vancouver
CO 8-hour 9 ppm	11/15/1990	10/11/1996	King
			Pierce
			Snohomish
		06/29/2005	Spokane
		10/21/1996	Vancouver
		12/31/2002	Yakima
PM_{10} 24-hour 150 µg/m^3	11/15/1990	5/14/2001	Kent
			King
			Pierce (*Tacoma*)
		12/4/2000	Thurston (*Olympia, Tumwater, and Lacey*)
		8/30/2005	Spokane
		9/26/2005	Wallula
		3/10/2005	Yakima
$PM_{2.5}$ 24-hour 35 µg/m^3	12/14/2009	3/12/2015	Tacoma-Pierce County

Source: Ecology 2015

CO = carbon monoxide, µg/m^3 = microgram(s) per cubic meter, NAAQS = National Ambient Air Quality Standards, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, ppm = part(s) per million.

3.2.3.3 *Vessel Corridor*

The Lower Columbia River and the Pacific Ocean coastline are subject to seasonal regional wind patterns that minimize air quality stagnation episodes in comparison to the rail routes that pass through inland mountain valleys. Other than the Vancouver maintenance area, no nonattainment or maintenance areas are designated along the Lower Columbia River. Vessels transiting within Washington's 3-nmi boundary beyond the mouth of the Columbia River would be in the open Pacific Ocean where no major air pollution sources exist.

3.2.4 Impact Assessment

3.2.4.1 Proposed Facility

Construction

Emissions

Construction activities related to the development of the proposed Facility are described in Section 2.3. These would include grading and excavation activities, ground improvements, foundation construction, and structure erection activities typical of an industrial facility. Construction would require the use of a variety of machinery including heavy trucks, excavators, graders, work vessels, pile drivers, and a range of smaller equipment, such as generators, pumps, and compressors. Construction activities at the marine terminal would involve demolition, pile strengthening, and new pile placement using a vibratory hammer and would likely involve the use of a barge-mounted crane. These activities and the use of motorized equipment would result in temporary, localized increases in emissions as estimated in Table 3.2-4. Detailed calculations and assumptions for these emission estimates can be found in Appendix G.

The estimated emissions for CO were compared to the General Conformity Rule (GCR) de minimis threshold to evaluate conformity. The emissions from all proposed construction activities were compared to the de minimis threshold of 100 tons per year to conservatively evaluate impacts. The remaining criteria pollutants were evaluated against the general Prevention of Significant Deterioration (PSD) 250-ton-per-year threshold to compare the level of emissions to that of a general major stationary source.

Construction CO emissions are estimated at 23.52 tons, well below the GCR de minimis threshold of 100 tons per year (i.e., 23 percent of the threshold). Consequently, a General Conformity Determination is not needed. The remaining criteria pollutants are all far below the relevant comparative thresholds; and thus, air quality impacts from these pollutants during construction would be expected to be minor.

Air Toxics, which would be generated by the operation of diesel-powered construction equipment, were not specifically quantified for the construction phase. Construction-related activities could result in DPM emissions from onroad haul trucks, tugboats, and offroad exhaust emissions from construction equipment. Due to the variable nature of construction activity, the generation of Air Toxic emissions would be temporary, especially considering the short amount of time for which such equipment typically operates within a distance that would result in the exposure of sensitive receptors to substantial concentrations. A sensitive receptor is a person in the population who is particularly susceptible to health effects due to exposure to an air contaminant. Sensitive receptors are typically located at:

- Schools, playgrounds, and childcare centers
- Long-term health-care facilities
- Rehabilitation centers
- Convalescent centers

- Hospitals
- Retirement homes
- Residences

Table 3.2-4. Estimated Emissions from Proposed Facility Construction

Project Element	Tons Per Year					
	VOCs	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$
Unloading and office area (Area 200)	0.51	2.44	5.48	0.12	5.02	0.86
Storage area (Area 300)	0.45	1.95	6.11	0.14	55.05	5.81
Marine terminal (Area 400): land	0.07	0.09	0.22	0.00	0.17	0.03
Marine terminal (Area 400): water	0.53	4.90	9.58	1.04	0.42	0.41
Transfer pipelines (Area 500)	0.01	0.02	0.07	0.00	0.88	0.09
Boiler building (Area 600)	0.01	0.05	0.11	0.00	0.09	0.02
Rail infrastructure	0.01	0.05	0.19	0.00	3.79	0.39
Material transport	0.62	3.27	14.86	0.01	0.63	0.61
Privately owned vehicles*	0.37	10.75	1.51	0.00	0.06	0.06
Total Construction Emissions	2.57	23.52	38.12	1.33	66.12	8.26
De minimis thresholds	NA	100	NA	NA	NA	NA
Comparative thresholds	250	NA	250	250	250	250
Exceedance?	No	No	No	No	No	No

Sources: See Appendix G

Note:

*Emissions from staff commutes were estimated based on 149 daily roundtrips (Kittelson Associates 2014).

CO = carbon monoxide, NO_x = nitrogen oxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, SO_2 = sulfur dioxide, VOCs = volatile organic compounds.

Concentrations of mobile-source DPM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (CARB 2005). In addition, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9, 40, and 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. As a result, producing accurate estimates of health risk is difficult.

As a conservative approach to the Air Toxics analysis, the presence of any sensitive receptors within 1,000 feet of the construction activity was evaluated. Because the proposed Facility site is bounded on the west and east by port and industrial activities, the south by the Columbia River, and the north by sparsely populated vegetated areas, the only sensitive receptor identified within the 1,000-foot boundary was the Clark County Jail Work Center (JWC).

The JWC includes dormitories to house adult inmates (in custody and work release). As of July 2015, the JWC had 90 residents with an average stay of approximately 18 days. It is anticipated that the resident population at the JWC will increase to nearly 200 residents by late 2015 as additional authorized corrections positions at the facility are filled. In addition to the inmate population, up to 26 corrections staff are present at the facility during daytime hours from Monday through Friday (Bishop, pers. comm., 2015).

Construction activities that would occur within 1,000 feet of the JWC include work on the eastern portion of the unloading facility, ground improvements and modifications at the marine terminal, and installation of the transfer pipelines. In addition, the Applicant proposes to install a temporary grout batch plant near the jet grout ground improvement operations at the marine terminal. The batch plant could be as close as 1,500 to 2,000 feet from the JWC.

Table 3.2-4 shows that emissions from all of the construction areas would be low with the exception of the storage area (Area 300). Conservatively assuming that all $PM_{2.5}$ generated by diesel equipment is DPM (i.e., excluding $PM_{2.5}$ as fugitive dust), the total estimated DPM emissions for all construction activities would be 1.54 tons per year. A 70 percent reduction of DPM emissions at 500 feet would result in a conservatively estimated maximum emission rate of 0.46 ton per year that could be released into the ambient air, and, therefore, have some impact to the JWC during construction.

Because the JWC residential facility is located at an active industrial port, its residents would not have the same air quality as a population located in an area where few or no industrial impacts exist. Therefore, the exposure to further reduced air quality during construction could negatively affect residents and staff working at the JWC. Any impacts to residents at the JWC during Facility construction would be minimized by the transitory nature of the adult population that is served by the JWC. Consequently, it is unlikely that construction emissions would cause more than a minor impact to nearby populations, such as those residing or working at the JWC.

To minimize the minor level impacts of Air Toxics and all other emissions that would be generated by temporary construction activities, the Applicant has proposed to implement the following BMPs from the Washington Associated General Contractors brochure titled *Guide to Handling Fugitive Dust from Construction Projects* (AGC 2009):

- Maintain offroad mobile equipment to minimize air emissions through proper operation
- Use offroad mobile construction equipment that meets applicable emissions standards
- Encourage carpooling or other trip-reduction strategies for construction workers
- Minimize construction truck and other vehicle idling
- Spray exposed soil with water or other suppressant as needed to reduce wind-blown emissions of PM and deposition of PM
- Pave or use gravel on staging areas and roads that would be exposed for long periods
- Minimize dust emissions from trucks transporting materials by using appropriate methods such as covering truck loads, wetting materials in trucks, or providing adequate freeboard (space between the top of the material and the top of the truck bed) to reduce PM emissions and deposition during transport
- Rock exits or provide wheel washers to remove PM that would otherwise be carried offsite by vehicles to decrease deposition of PM on area roadways
- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris

The relocation of the natural gas pipeline and associated excavation activities would involve a much smaller scale of disturbance compared to other construction activities. Such activities would result in negligible, temporary, and localized increases in PM emissions from construction-related sources.

Odor

Facility construction would generate odors that may be perceptible to nearby sensitive receptors (e.g., the JWC). Oil-based paints applied to structures or equipment at the site may result in perceptible paint odors nearby. These impacts are anticipated to be slight, localized, and of short duration. Construction contractor(s) would be required to comply with Ecology regulatory requirements at WAC 173-400-040(5) requiring anyone generating odors that may unreasonably interfere with any other property owner's use and enjoyment of their property to use recognized good practices and procedures to reduce odors to a reasonable minimum.

Operation and Maintenance

Emissions

The proposed Facility would result in emissions from the following stationary sources:

- Three natural gas–fired boilers
- Eight MVCUs
- Crude oil handling components (e.g., valve seals and pressure relief valves)
- Crude oil storage tanks
- Emergency diesel-powered fire pump engines
- Emergency portable diesel-powered generators

Operational stationary sources would result in increases in emissions as estimated in Table 3.2-5. Detailed calculations for this analysis can be found in the Revised Air Permit Application.

Table 3.2-5. Estimated Stationary Source Operations Emissions for the Proposed Facility

Activity	Tons Per Year						
	VOCs	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	HAPs
Boiler use (Area 600)	2.70	19.5	5.95	1.99	4.06	4.06	0.02
MVCU	8.64	3.49	8.04	6.59	2.62	2.62	0.77
Component leaks	0.82	NA	NA	NA	NA	NA	<0.00
Tanks	23.58	NA	NA	NA	NA	NA	1.87
Firewater pumps	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Emergency generators*	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary Source Emissions	35.75	23.02	14.00	8.57	6.68	6.68	2.66
PSD thresholds/HAP threshold	100	100	100	100	100	100	25
Exceedance?	No	No	No	No	No	No	No

Source: Vancouver Energy 2014

Note:

*Emergency generators would be available in the event of a power failure. Emissions have not been estimated for this scenario.

CO = carbon monoxide, HAPs = hazardous air pollutants, MVCU = marine vapor combustion unit, NO_x = nitrogen oxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, VOCs = volatile organic compounds

The estimated emissions were compared to the following:

- The stationary source criteria pollutant emissions were compared to the 100-ton PSD threshold that applies to "petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels" as defined in 40 Code of Federal Regulations (CFR) 52.21(v).
- The total combined value for HAPs (25 tons per year) was evaluated because no individual HAP emission estimates approach come close to the 10-ton-per-year HAP limit for a single HAP.

Results indicate that the estimated criteria pollutant and HAP stationary source emissions would not exceed any of the thresholds. CO would be emitted in the greatest quantity at an estimated 35.75 tons per year, which is 35 percent of the threshold. HAP emissions at an estimated 2.66 tons per year, would be approximately 10 percent of the threshold. Consequently, air quality impacts from these pollutants would be expected to be minor from stationary source operations.

In addition to permitted stationary source emissions, mobile source emissions at the proposed Facility would result from locomotive and vessel operations. These onsite and near-site operational emissions were quantified to include:

- Locomotive operations from trains approaching, idling onsite, and departing the Facility
- Vessels transiting within 1-nmi of the terminal (approach and departure)
- Tug activity maneuvering vessels to and from berths
- Hoteling

Emissions that would be generated from terminal employees driving to and from work were also included.

These resulting increases in emissions from mobile source operations at the proposed Facility were also estimated and are shown in Table 3.2-6. Detailed calculations and assumptions for these estimates can be found in Appendix G.

Table 3.2-6. Estimated Mobile Source Operations Emissions for the Proposed Facility

Activity	Tons Per Year						
	VOCs	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	Formaldehyde
Locomotive operations	2.06	13.67	42.78	0.03	1.08	1.04	0.02
Vessel operations (maneuvering, hoteling)	4.08	18.85	103.52	42.79	5.19	4.80	0.61
Privately owned vehicles*	0.92	26.93	3.78	0.01	0.15	0.14	ND
Total	7.06	59.45	150.08	42.83	6.42	5.98	0.63
Comparative thresholds	250	250	250	250	250	250	10
Exceedance?	No	No	No	No	No	No	No

Sources: See Appendix G

Note:

*Commuting staff emissions were estimated based on 532 daily trips (Kittelson Associates 2014).

CO = carbon monoxide, NO_x = nitrogen oxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, SO_2 = sulfur dioxide, VOCs = volatile organic compounds

Although no regulatory thresholds exist for mobile sources, the estimated emissions from mobile source operations were compared to the following:

- The mobile source criteria pollutant emissions were compared to the general PSD 250-ton-per-year threshold to compare the level of emissions to that of a general major stationary source.
- Formaldehyde, the organic HAP generated at greatest concentration from fossil fuel combustion, was compared to the stationary source individual HAP limit of 10 tons per year as a comparative threshold.

Results indicate that none of the criteria pollutants would be emitted in excess of the 250-ton-per-year comparative threshold. NOx would be emitted in the greatest quantity at an estimated 150 tons per year, which is 60 percent of the threshold. Formaldehyde would be emitted at less than 1 ton per year, which is approximately 6 percent of the HAP comparative threshold. Consequently, air quality impacts from these pollutants would be expected to be minor to moderate from onsite and near-site mobile source operations.

Total combined stationary source and onsite and near-site mobile source operational emissions are presented in Table 3.2-7.

Table 3.2-7. Total Stationary and Mobile Source Emissions for Proposed Facility Operations

Activity	Tons Per Year						
	VOCs	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	HAPs
Stationary source emissions	35.75	23.02	14.00	8.57	6.68	6.68	2.66
Mobile source emissions	7.06	59.45	150.08	42.83	6.42	5.98	0.63*
Combined Total	42.81	82.47	164.08	51.40	13.10	12.66	3.29
Comparative thresholds	250	250	250	250	250	250	25
Exceedance?	No	No	No	No	No	No	No

Sources: Vancouver Energy 2014, See Appendix G

Note:

*Mobile source HAPs were only quantified for formaldehyde, the organic HAP generated at greatest concentration from fossil fuel combustion.

CO = carbon monoxide, HAPs = hazardous air pollutants, NO_x = nitrogen oxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, SO_2 = sulfur dioxide, VOCs = volatile organic compounds.

Total annual emissions associated with Facility operations from both stationary and onsite and near-site mobile sources were combined and compared to the PSD comparative threshold for criteria pollutants and the individual pollutant threshold for HAPs.

As shown in Table 3.2-7, results indicate that the total annual emissions resulting from the Facility's operations (i.e., stationary and mobile sources) would not exceed any of the thresholds. The largest criteria pollutant emissions were for NOx, and the 164 tons per year that have been estimated would be approximately 65 percent of the 250-ton-per-year comparative threshold. HAP emissions at an estimated 3.29 tons per year, would be approximately 13 percent of the 25-ton-per-year comparative threshold. Consequently, air quality impacts would be expected to be minor to moderate from combined emissions from stationary and mobile source operations.

Criteria Air Pollutant Dispersion Modeling Results

Criteria pollutant operational impacts were further evaluated through air quality dispersion modeling. The modeling results for CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ are based on a combination of stationary and onsite and near-site mobile sources and are shown in Table 3.2-8.[4] Detailed information on the modeling and results can be found in Appendix F. As indicated, all model-projected future concentrations of these pollutants with full operation of the proposed Facility are much lower than the levels allowed by the ambient air quality standards, ranging from 1.8 percent to 93.1 percent of corresponding ambient standards.

Table 3.2-8. Modeling Results: Maximum Criteria Pollutant Concentrations for Stationary and Mobile Sources Operating at the Proposed Facility (µg/m³)

Criteria Air Pollutant	Averaging Time	Background Concentrations[a]	Project-Related Concentration[b, c]	Project Plus Background Concentration	Ambient Standard[d]	Predicted vs Standard (%)
CO	1-hour	3,550	348.1	3,898	40,000	9.7
	8-hour	2,519	69.0	2,588	10,000	25.9
NO_2	1-hour	Variese	Based on Monte Carlo Simulations	175	188	93.1
	Annual	16.9	29.6	46	100	46.0
$PM_{2.5}$	24-hour	20.5	5.4	26	35	74
	Annual	7f	0.7	8	12	66.7
PM_{10}	24-hour	34	10.5	45	150	30.0
	Annual	13f	0.7	14	50	28.0
SO_2	1-hour	12.8	43.8	57	196	29.1
	3-hour	7.1	16.0	23	1,310	1.8
	24-hour	4.5	12.6	17	365g	4.7
	Annual	3.9f	0.3	4	52g	7.7

Source: ENVIRON 2014

Notes:

a Background concentrations (expressed as µg/m³) based on measured levels (see Table 3.2-2).

b Reported pollutant concentrations are those occurring at the maximum impact location for each pollutant. Concentrations at all other locations are less than those reported here.

c Except as noted below, all of the short-term concentrations are based on modeling that considered maximum hourly activity during every hour of the 5-year meteorological data set, which is not a possible actual level of activity. These results are therefore intentionally skewed to represent very conservative conditions. Note that consistent with EPA guidance, the annual modeling results are based on 5-year averages from the 5-year meteorological data set instead of 3-year averages as per the NAAQS.

d All ambient concentrations are expressed in terms of µg/m³; Table 3.2-1, which presents only the ambient air quality standards, includes some concentrations reported in ppm.

e Hourly variations by season were considered in the dispersion modeling as explained in Seasonal/Hourly Background Concentrations section. Thus, the modeling included background concentrations. Refer to Monte Carlo Post-Processing Simulations discussion for additional information.

f Value represents maximum measured concentrations; it does not reflect statistical treatment and is therefore conservative.

g Denotes WAAQS only (i.e., no federal standard).

CO = carbon monoxide, EPA = US Environmental Protection Agency, NAAQS = National Ambient Air Quality Standards, NO2 = nitrogen dioxide, PM10 = suspended particulate matter less than or equal to 10 microns in diameter, PM2.5 = fine PM less than or equal to 2.5 microns in diameter, SO2 = sulfur dioxide, WAAQS = Washington Ambient Air Quality Standards

The maximum model-calculated pollutant concentrations, including background concentrations and their locations, are depicted in Figures 3.2-3 and 3.2-4. As shown, most of the maximum Facility-related

4 The dispersion model does not evaluate VOCs, which are ozone precursors and, therefore, ozone is not addressed in the modeling results. Instead, VOC emissions were quantified using emission factors and compared to the PSD thresholds in Tables 3.2-5 through 3.2-7.

concentrations would occur on or very near the property boundary. Although some of these maximum concentrations occur near the JWC's dormitories (i.e., NO_2, $PM_{2.5}$, PM_{10}), all concentrations are lower than the levels allowed by ambient air quality standards. The maximum concentrations (i.e., SO_2 1-hour and CO 1-hour) that would occur farther from the property boundary (see Figure 3.2-4) represent emissions primarily from vessels, which are generally hotter and emitted at greater elevation. Therefore, these emissions are less likely to impact sensitive receptors that are generally located at lower elevations. Consequently, air quality impacts from these pollutants would be expected to be minor to moderate from proposed Facility operation and maintenance.

Toxic Air Pollutants and Dispersion Modeling Results

The proposed Facility would have the potential to emit HAPs as defined under the Clean Air Act Section 112 and TAPs as defined under WAC 173-460. The HAP that would be emitted in greatest quantity from proposed Facility stationary sources is hexane (1.75 tons per year). Hexane emissions would be primarily generated from the boiler and MVCU operations and are estimated to be less than the 10-ton-per-year threshold. Total HAP emissions, including hexane, from proposed Facility stationary sources would be 2.66 tons per year, less than the 25-ton-per-year threshold.

Emissions from eight TAPs (i.e., arsenic, benzene, cadmium, chromium (hexavalent), DPM, 7,12-dimethylbenz(a) anthracene, NO_2, and SO_2) exceeded the applicable Washington small quantity emission rate (i.e., a screening impact level), based on operational emission estimates for the proposed Facility stationary sources (i.e., excluding mobile sources) and, thus, dispersion modeling was conducted to assess projected compliance with Ecology's published Acceptable Source Impact Levels (ASILs). The modeling conducted by the Applicant demonstrated that the maximum predicted concentrations attributable to the proposed Facility's emission units are less than the Ecology ASILs for all eight TAPs. Therefore, air quality impact levels of Air Toxics from the proposed Facility stationary source operations are expected to be minor. A detailed discussion of this modeling can be found in the Revised Air Permit Application (Vancouver Energy 2014).

The dispersion modeling of the proposed Facility stationary source operations was expanded for DPM to include onsite and near-site mobile sources to assess potential health effects from diesel emission sources.[5] This analysis of mobile sources is not required for air quality permitting, so no comparison thresholds exist. Figure 3.2-5 shows the DPM concentrations based on annual average $PM_{2.5}$ concentrations attributable to the combination of Facility stationary and related mobile sources within the 10 kilometer × 10 kilometer (6.2 × 6.2 mile) modeling domain.

The estimated DPM concentration at the JWC would be between 0.5 and 0.76 $\mu g/m^3$. At the location of the nearest residential receptor (Fruit Valley Residential Area), the estimated DPM concentration would be between 0.05 and 0.15 $\mu g/m^3$. The low concentration of DPM at the Fruit Valley Residential Area is anticipated to result in minor air quality impacts to residents in that area. The DPM concentration at the JWC is much higher. However, the duration of housing there is, on average, approximately 18 days for the residents (Bishop, pers. comm., 2015). Although the JWC has higher estimated concentrations of DPM, inhalation of emissions would be experienced less than at residential receptors where residents are present for a large portion of every day, for a number of years. Air quality impacts at commercial and industrial receptors (including staff at the JWC and other worksites in close proximity to the proposed Facility) are therefore expected to be moderate.

5 ASILs represent impact levels intended to be used during permitting processes for stationary sources. ASILs do not apply to mobile sources. They are an indicator of potential risk of an increase in cancer rates to 1 in 100,000 people exposed for 70 years. The ASIL for DPM is 0.15 $\mu g/m^{3.}$

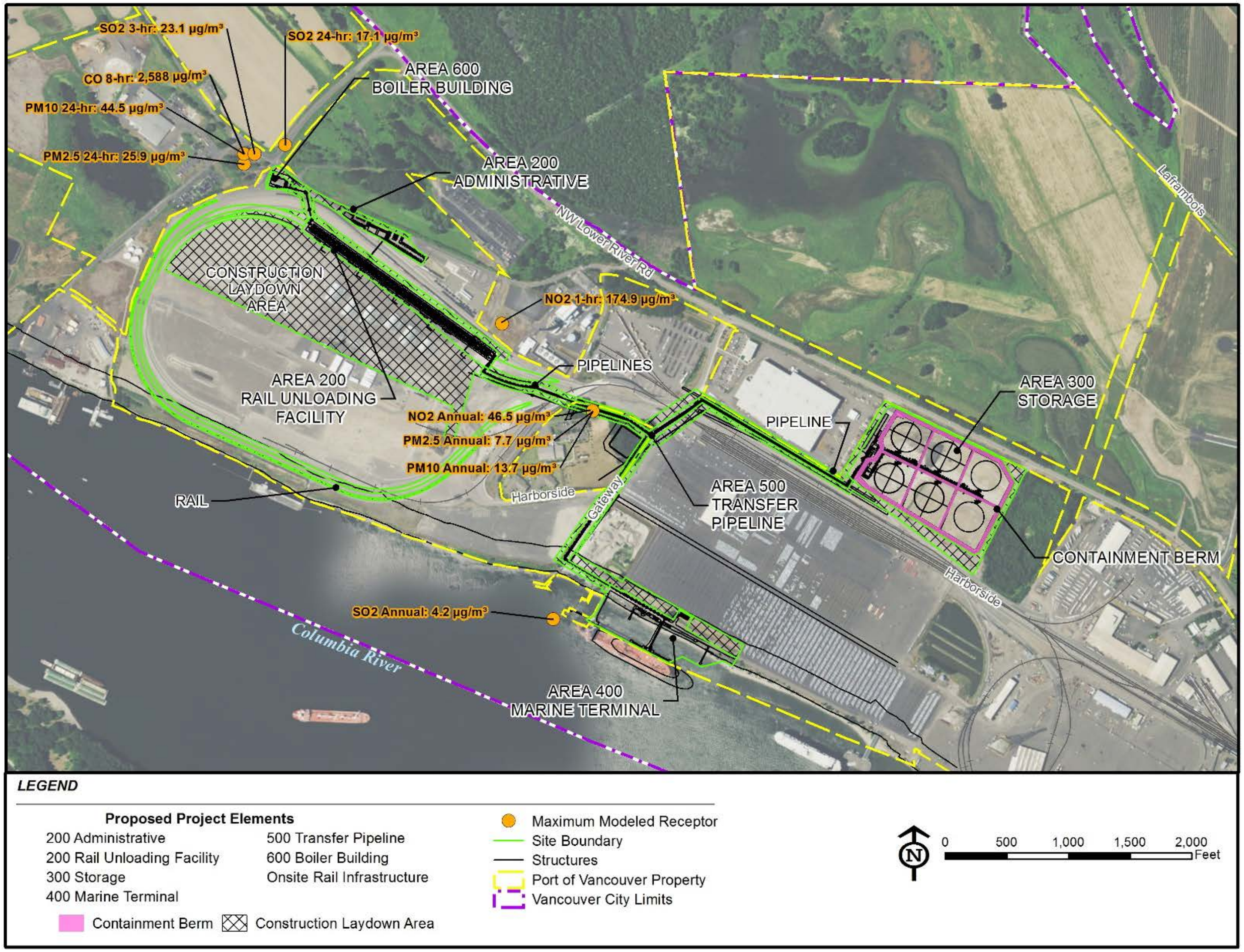

Figure 3.2-3. AERMOD Projected Maximum Criteria Pollutant Concentrations During Operations—Western Portion of Modeling Domain

Source: BergerABAM 2014

Note: The yellow lines depict Port parcels and the orange dots show the points of maximum concentrations. An enlarged version of this figure is available in Appendix P.11.

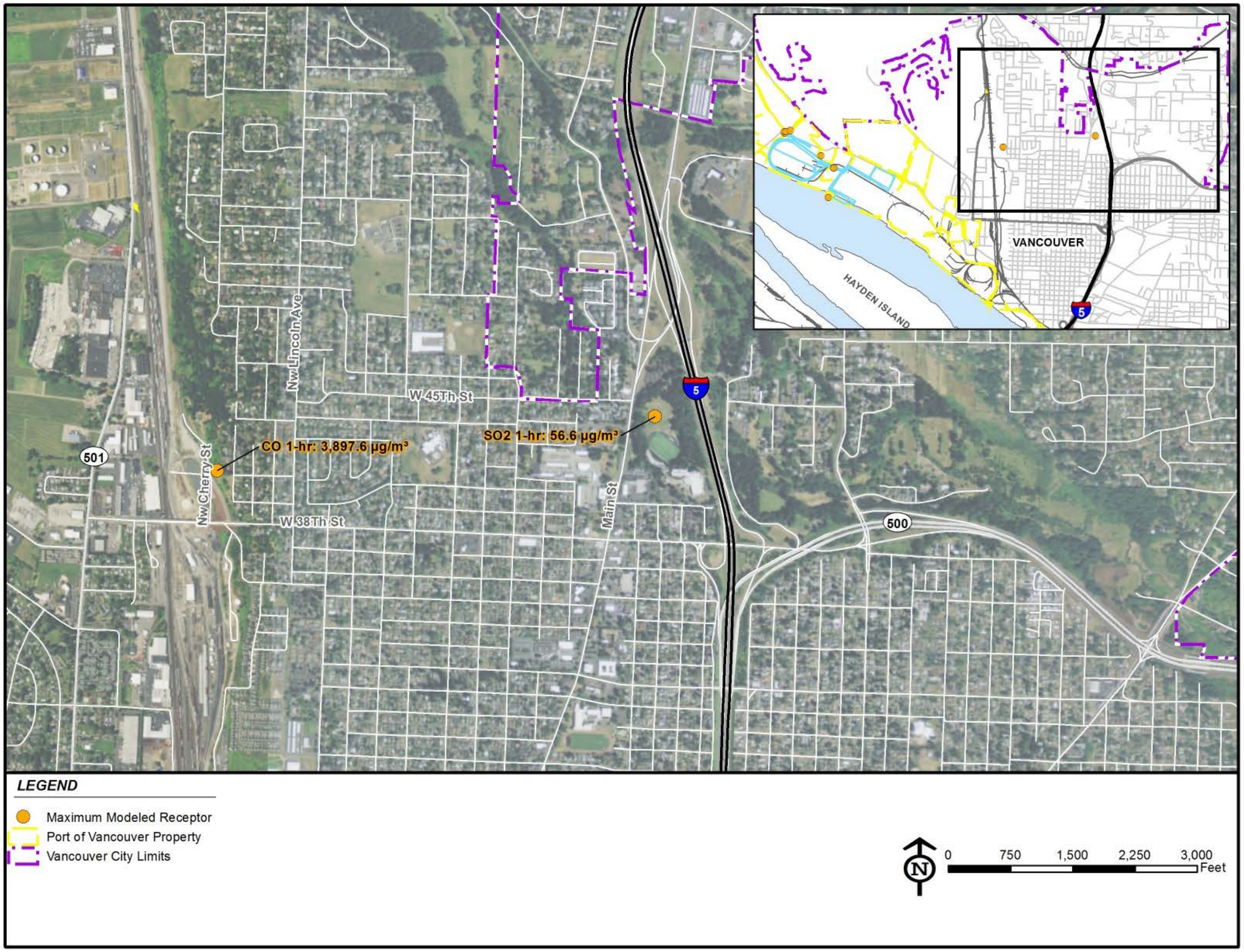

Figure 3.2-4. AERMOD Projected Maximum Criteria Pollutant Concentrations During Operations—Eastern Portion of Modeling Domain

Source: BergerABAM 2014

Note: The yellow lines depict Port parcels and the orange dots show the points of maximum concentrations. An enlarged version of this figure is available in Appendix P.11.

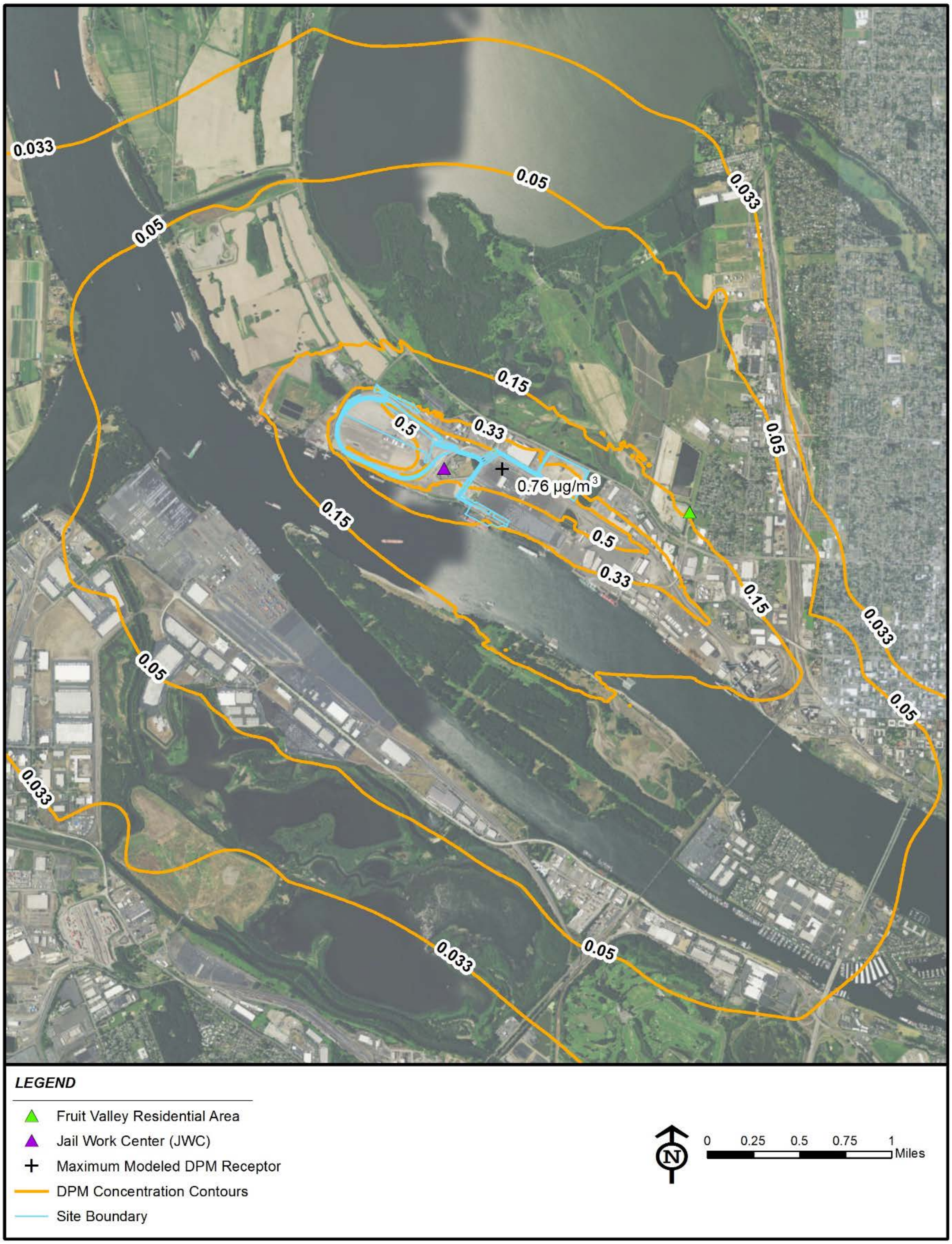

Figure 3.2-5. AERMOD Projected Annual Average $PM_{2.5}$ (µg/m^3) (Surrogate for DPM)

Source: BergerABAM 2014

Vehicle Traffic Air Quality Impacts

EPA guidance (EPA 1992) suggests evaluating intersections to determine if project-related traffic could affect the operational performance or *level of service* (LOS) of a signalized intersection to the degree that unstable flow conditions could occur that would create localized "hotspots" for CO. One signalized intersection near the proposed Facility (Old Lower River Rd/State Route (SR) 501) was evaluated for air quality impacts using existing and projected traffic data (Kittelson Associates 2014). Based on the traffic data, the signalized intersection would not be adversely affected by proposed Facility–related vehicle traffic to the extent that the LOS would substantially decline (see also Section 3.14.3.1). Therefore, air quality impacts from Project-related vehicle traffic operations would be negligible.

Odor

Some odors would be produced during operations. Vessel tank gases vented to the MVCUs during product loading contain hydrocarbons and reduced sulfur compounds that could contribute to periods of offensive odor if these compounds were not oxidized in the vapor combustor. Air quality modeling of vapor combustor emissions conducted by the Applicant for the Application for Site Certification indicated the maximum SO_2 concentrations attributable to MVCU emissions would not exceed the odor threshold for SO_2 (≈1,230 µg/m^3) at any location outside the property boundary (Vancouver Energy 2014). Furthermore, the NAAQS for SO_2 (196 µg/m^3), intended to protect human health, is sufficiently lower than the average human detection threshold for SO_2 for odor impacts. As shown in Table 3.2-8, the maximum concentration of SO_2 for all stationary and mobile sources at the proposed Facility is 57 µg/m^3, which includes background concentrations. Consequently, odor impacts from operations of the proposed Facility would be expected to be negligible.

Other minor transient odor impacts attributable to diesel-fueled locomotives could occur during operation. These impacts likely would not extend beyond the property boundary or would be indistinguishable from unrelated existing industrial and vehicle operations in the Port vicinity. Facility operators would be required to comply with general standards for maximum emissions from air pollution sources outlined in WAC 173-400-040 intended to control odors.

Effects of Air Emission Deposition onto Water

Deposition of air pollution, especially airborne particles onto land and water, can result in contamination from substances such as mercury, dichlorodiphenyltrichloroethane, PCBs, and polybrominated diphenyl ether (PBDE) flame retardants. The occurrence of these substances in the Columbia River Basin was reported in a EPA study (EPA 2009). The primary contributors to such pollution within the entire basin are global sources outside this region that contribute mercury pollution via atmospheric deposition. Additional local sources within the river basin include energy production facilities (e.g., power plants), mining, agriculture, industry, and transportation-related activities (EPA 2009). The Portland area hosts the largest and most diverse array of manufacturing and production facilities in the Columbia River Basin operating under the Toxics Release Inventory or NPDES (Hinck et al. 2004). Additional industrial sources are located throughout the basin.

The primary sources of PM emissions associated with the proposed Facility would be diesel-fueled stationary sources, locomotives, and vessels (refer to Table 3.2-7 for the combined total PM emissions). The potential for this low level of PM emissions from proposed Facility sources to result in deposition of fine particles into the Columbia and Willamette rivers was examined using the AERMOD dispersion modeling system (BergerABAM 2014). The results of this analysis are depicted on Figure 3.2-6, which presents isopleths[6] representing the model-calculated annual average deposition rates from proposed Facility sources in terms of milligrams per square meter (mg/m^2). As shown, the annual deposition rates from diesel sources are quite small (i.e., ranging from 0.1 to 2.0 mg/m^2). To provide a context for such

6 An isopleth is a line on a map connecting points at which a given variable has a specified constant value.

deposition rates, an area approximately 1 × 1 kilometer (0.62 × 0.62 mile) centered over the river and encompassing most of the proposed Facility area was examined in greater detail. This analysis indicated a total annual deposition rate within this 1-square-kilometer area of greatest deposition of 1.35 kilograms (2.97 pounds) per year from proposed Facility–related diesel sources operating on and near the site. Deposition at more distant locations would be less. Refer to Section 3.3 for further discussion of the effects of deposition on water resources.

Decommissioning

Decommissioning the proposed Facility would include construction activities similar to those required during Project construction. The potential for air quality impacts from such activities would be the same as those associated with general construction of the proposed Facility, and would primarily result from the operation of heavy-duty diesel equipment, the generation of fugitive dust from movement of these vehicles, and any earth-moving activities. Emissions impacts would be minimized by the application of basic construction impact reduction measures proposed by the Applicant, such as minimize idling times of construction equipment; covering all haul trucks transporting soil, sand, or other loose material to/from the site; and watering all exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads).

3.2.4.2 *Rail Transportation*

Air quality modeling for proposed Facility operations evaluated the maximum emission rate from onsite and near-site rail activities. The analysis indicated little potential for notable air quality impacts from emissions of criteria air pollutants (refer to Table 3.2-8). The operations considered in the modeling analysis included locomotive emissions from approaching, idling onsite, and departing the proposed Facility.

At more distant locations along the rail corridor, the trains would be temporary emission sources moving through any given area in a short period of time. While it was not possible to model such emissions due to the many unknown variables along the rail routes (e.g., varying meteorology, terrain, and the presence of other emission sources), total annual emissions can be estimated using known operational parameters, published Class I railroad data, and emission factors. Table 3.2-9 presents estimated maximum annual emissions estimates for unit trains traversing Washington, using the Columbia River Alignment with loaded tanker cars and using the Stampede Pass Alignment with empty tanker cars. The results are compared to the statewide emission inventory for rail transit completed for 2011 (Ecology 2014b). Detailed calculations and assumptions for these estimates can be found in Appendix G.

Table 3.2-9. Estimated Maximum Rail Transit Emissions

Rail Segment	Tons Per Year						
	VOCs	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	Formaldehyde
Columbia River Alignment	71	502	1,503	1.25	38	37	0.12
Central Return - Stampede Pass Alignment	27	195	583	0.5	15	14	0.05
Total	98	697	2,086	1.75	53	51	0.17
2011 Washington State Emission Inventory for Rail Transit	810	2,536	15,026	95	430	428	ND
% of Emission Inventory that Proposed Rail Emissions Would Represent	12%	27%	14%	2%	12%	12%	ND

Sources: See Appendix G

CO = carbon monoxide, ND = not determined, NO_x = nitrogen oxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, SO_2 = sulfur dioxide, VOCs = volatile organic compounds

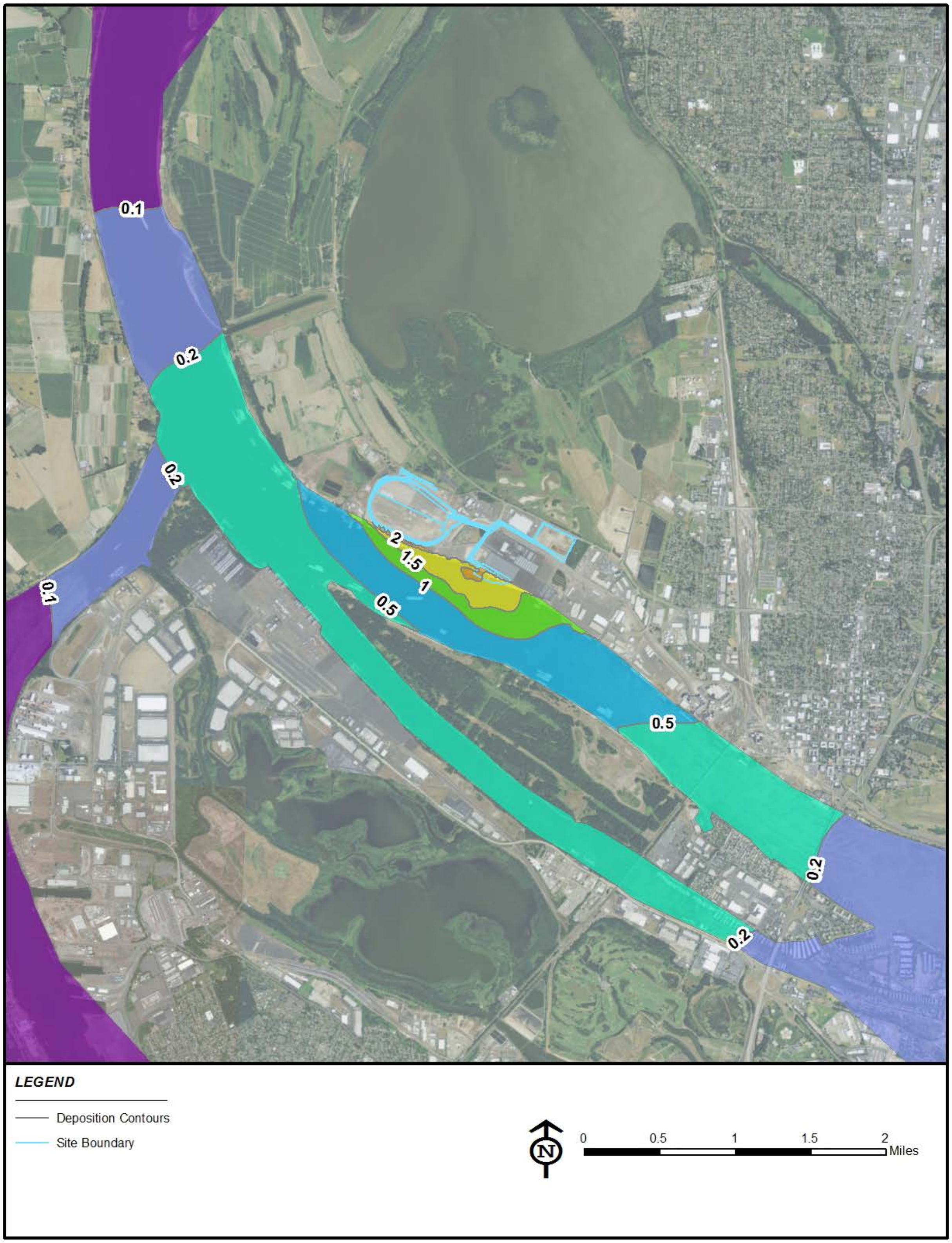

Figure 3.2-6. AERMOD Estimated Annual Average DPM Deposition into the Columbia and Willamette Rivers (mg/m^2)

Source: BergerABAM 2014

Comparison to the 2011 emission inventory for rail transit in Washington indicates that the estimated operations emissions for this scenario would represent between 2 and 27 percent of the 2011 rail transit emissions, with most pollutant emissions representing approximately 12 percent of the inventory amounts.

Air quality impacts for specific segments would vary as a function of the additive rail traffic, the current state of air quality along the segment, whether the train traveling along the segment is full or empty, the speed at which the train traverses the segment, and other factors. Air quality impacts to Class I Wilderness Areas close to the rail route (e.g., Glacier National Park and Cabinet Mountains Wilderness Area in northern Montana) would result from up to eight additional trains per day passing near these areas. Currently, approximately 48 trains per day travel near Glacier National Park and Cabinet Mountains Wilderness Area. The increase in emissions would be comparable to the increase in rail traffic near the wilderness areas at approximately 16 percent (i.e., 48 to 56 trains). This scenario would represent a minor increase in rail traffic and could be assumed to additionally represent a minor increase in air emissions in the vicinity of the Class I Wilderness Areas. Deliberately reducing the number of trains to/from the proposed Facility traveling near pristine areas would reduce increases in rail traffic and associated air emissions.

Rail-Caused Vehicle Delays

The potential for air quality impacts due to increases in vehicle delays near railroad/street crossings that would be obstructed by Project-related unit trains was also considered. The addition of eight trains per day would result in an increased delay of approximately 41 minutes per crossing per day (Table 3.14-14). When accounting for the number of affected vehicles and the number of trains on the Columbia River and Central Return - Stampede Pass alignments (i.e., four unit trains per day on the Vancouver to Pasco segment, and eight unit trains per day on the Pasco to Washington state line segment), the total combined vehicular delay would be 90 hours each day.

As indicated in Section 3.14.3.2, the incremental additional delay caused by gate downtime would be experienced at 200 roadway-railroad at-grade crossings along the 445-mile Columbia River Alignment. Ten of these at-grade crossings (in Spokane, Pasco, and the greater Vancouver area) have an average annual daily traffic volume of 2,500 vehicles or more (Figure 3.14-7). Trains passing through these crossings would be more likely to affect traffic than other crossings along the Columbia River Alignment, particularly if the crossings coincide with peak commuting periods. Vehicles idling while delayed at these crossing locations would temporarily increase emissions. However, the increase in emissions would be anticipated to be less than significant. In more rural areas, likely fewer vehicles would be idling, resulting in smaller, localized increases in emissions.

Operating Practices and Requirements

EPA requires all newly manufactured and all remanufactured locomotives that were originally manufactured after 1972 to comply with increasingly stringent emission standards and to be equipped with idle reduction technology that automatically shuts down locomotives if they are left idling unnecessarily (EPA 2013b). EPA regulatory requirements also include a rigorous emission testing program to ensure locomotives comply with emission standards for their operational life. The average lifespan of a diesel locomotive is 40 to 50 years, so emission reductions are gradual. Typically, these engines are remanufactured about every 10 years and when this process occurs, the engine is upgraded to currently applicable standards. Thus, the idling control program is expected to eventually reduce NOx, volatile organic compounds (VOCs), and PM emissions by about 90 percent as well as significantly reduce smoke emissions and exhaust odors (EPA 2013b). These measures would reduce future emissions compared with both past and present locomotive emissions.

BNSF, which serves as the primary rail carrier in the region, has been modernizing its locomotive fleet in response to the federal regulatory requirements noted above. On a fleetwide basis, emissions from BNSF locomotives have been decreasing since 1995. Figure 3.2-7 illustrates this decreasing trend for PM and NOx locomotive emissions, based on grams of pollutant emitted per gallon of fuel consumed.

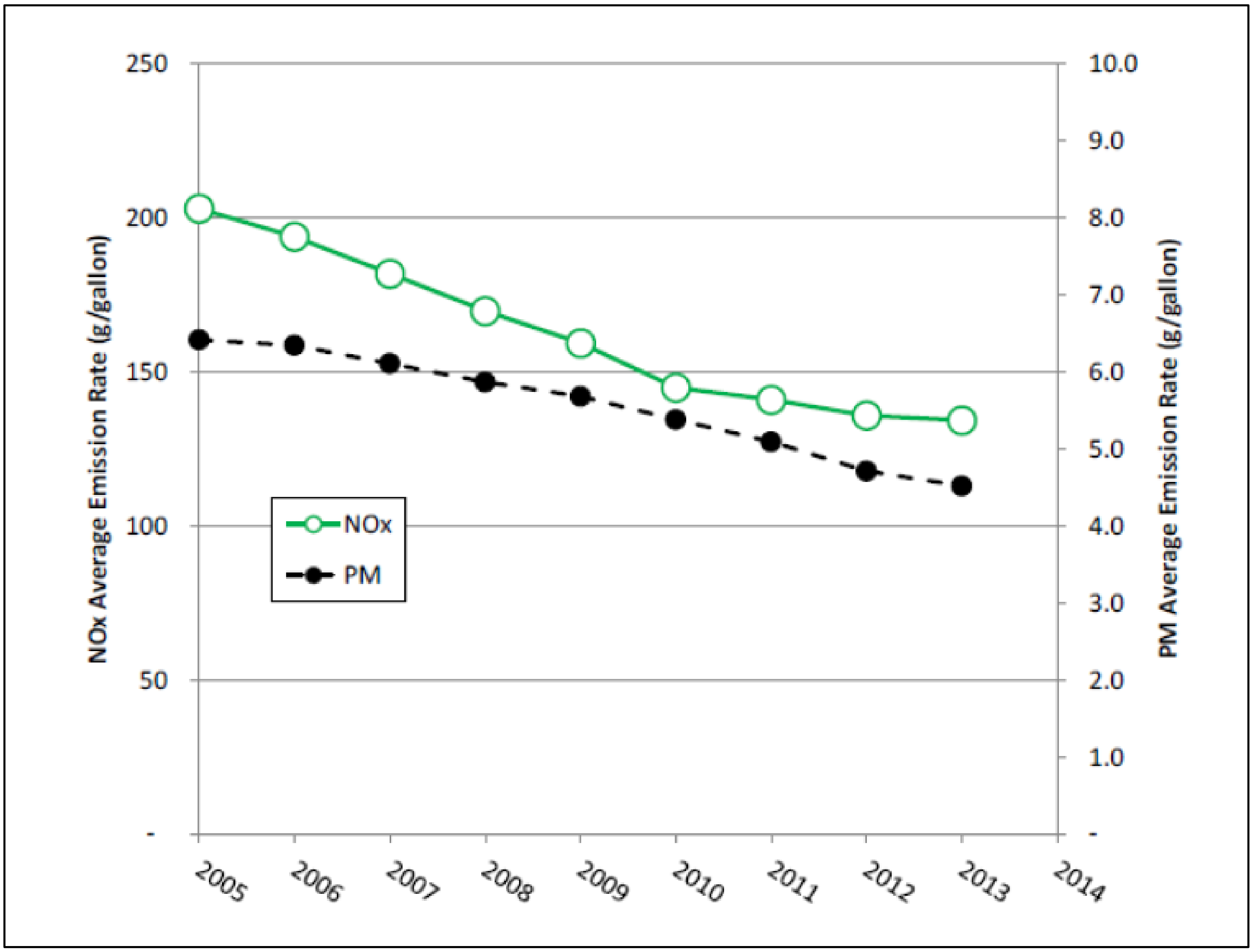

Figure 3.2-7. BNSF Fleetwide NOx and PM Emissions, 2005–2014

Source: BNSF 2014

3.2.4.3 *Vessel Transportation*

Air quality modeling for proposed Facility operations evaluated the maximum emission rate from onsite and near-site vessel activities. The analysis indicated little potential for notable air quality impacts from emissions of criteria air pollutants (refer to Table 3.2-8). The operations considered in the modeling analysis included emissions from oil tanker vessels in transit over about 1 nmi downriver from the Facility, vessels hoteling while at berth, and tugs assisting tankers during docking and undocking.

The maximum emissions from Project-related vessels transiting the Columbia River were quantified to the 3-nmi boundary and are presented in Table 3.2-10. These emissions are based on an estimated 730 roundtrips per year by Panamax-size crude oil tankers calling at the marine terminal. The calculations are based on a transit of approximately 115 miles each way. The results are compared to the statewide emission inventory for ships completed for 2011 (Ecology 2014b). Detailed calculations and assumptions for these estimates can be found in Appendix G.

Table 3.2-10. Estimated Maximum Vessel Transit Emissions

Activity	Tons Per Year						
	VOCs	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	Formaldehyde
Vessels transiting up and down Columbia River (to 3-nmi boundary)	18.50	44.09	538.43	121.75	14.93	13.89	2.77
2011 Washington State Emission Inventory for Ships	782	2,521	20,486	11,529	1,213	1,021	ND
% of Emission Inventory that Proposed Vessel Emissions Would Represent	2%	2%	3%	1%	1%	1%	ND

Source: See Appendix G

Note: Most vessels expected to call at the proposed Facility would be smaller to medium-sized tankers; therefore, these emission estimates are considered conservative.

CO = carbon monoxide, ND = not determined, nmi = nautical mile(s), NO_x = nitrogen oxide, PM_{10} = suspended particulate matter less than or equal to 10 microns in diameter, $PM_{2.5}$ = fine PM less than or equal to 2.5 microns in diameter, SO_2 = sulfur dioxide, VOCs = volatile organic compounds

Emissions from Project-related vessels were compared to the 2011 state emission inventory for ships. The emissions from vessels transiting to and from the Facility would represent 1 to 3 percent of the 2011 emission inventory amounts.

Other than the Vancouver maintenance area, no nonattainment or maintenance areas are designated along the Lower Columbia River. Furthermore, the vessel route beyond the mouth of the Columbia River would be in the open ocean where, with the exception of large urban centers located along the coastline, no major air pollution sources exist. Consequently, the increases in vessel traffic and associated air emissions would have a minor impact to air quality.

Operating Practices and Requirements

Large vessel engine emission specifications are set based on requirements of the International Maritime Organization (IMO). The IMO controls pollution from ships through the "International Convention on the Prevention of Pollution from Ships," known as MARPOL 73/78, or the MARPOL Convention. The MARPOL Convention has been amended by Annex VI titled "Regulations for the Prevention of Air Pollution from Ships." This annex sets limits on NOx and sulfur oxide (SOx) emissions from ship exhausts and prohibits deliberate emissions of ozone-depleting substances. In March 2010, the IMO accepted the proposal from EPA to designate waters off the North American coasts as an Emission Control Area. The control area extends up to 200 nmi off both the US East and West coasts. MARPOL Annex VI requires that SOx and NOx emissions be reduced starting in 2012 through the use of cleaner marine fuels or by addition of exhaust systems to capture emissions (DNV 2011). In 2020, emissions from ships operating in the North American Emission Control Area are expected to be reduced by 320,000 tons per year for NOx, 90,000 tons for $PM_{2.5}$, and 920,000 tons for SOx, which represent reductions of 23, 74, and 86 percent, respectively, below predicted levels in 2020 absent the Emission Control Area (EPA 2010). The vessels that would transit the Columbia River as a result of Facility operations would be required to comply with these standards and as a result, emissions of NOx, SOx and $PM_{2.5}$ would decrease over time.

3.2.4.4 Greenhouse Gas Emissions

GHG emissions were evaluated for all processes associated with the proposed Facility, including:

- Construction of the proposed Facility
- Onsite operation of the proposed Facility

- Offsite transport of crude oil to the proposed Facility using rail
- Offsite transport of crude oil away from the proposed Facility after loading onto vessels

Emissions were evaluated in terms of their categorization into Scope 1, 2, or 3 emissions as explained below.

Scope 1 emissions would occur from sources that are owned or controlled by the proposed Facility (direct emissions) and include such actions as:

- Onsite combustion of fossil fuels for operations
- Fugitive emissions

Scope 2 emissions (indirect emissions) would be generated from purchased electricity or steam consumed by the proposed Facility.

Scope 3 emissions (indirect emissions) would be a consequence of the activities at the proposed Facility but occur from sources not owned or controlled by the proposed Facility, including:

- Heavy machinery emissions during site preparation, construction, or decommissioning activities
- Combustion emissions from leased or contractor onroad and nonroad mobile sources used as part of construction, maintenance, and Facility operation (e.g., heavy machinery, maintenance equipment, trains, and boats)
- Combustion emissions from vehicle trips generated by the Project during construction and operation, including those of employees, customers, vendors, and residents
- Supply chain transportation emissions generated by transporting feedstock to the completed Facility and transporting products away from the Facility, and new shipping emissions that are caused by the Project

During construction, GHG emissions would be generated from Scope 2 and Scope 3 activities. Scope 2 emissions would be generated offsite at the point of power generation. At this time, it is not possible to estimate how much electricity would be purchased and consumed during construction. Scope 3 emissions are primarily from the operation of heavy-duty diesel equipment, highway vehicles, and marine engines. Fuel combustion would generate CO_2, methane, and nitrous oxide emissions. Using the global warming potential of 25 for methane and 298 for nitrous oxide, the total emissions from all three GHGs were summed to calculate CO_2e.

Table 3.2-11 presents the estimated GHG emissions that would result from construction activities, which would be expected to last for approximately 1 year. For comparative purposes, the estimated GHG emissions from construction of the proposed Project are analyzed against the 25,000-metric-ton-per-year Ecology guidance threshold (Ecology 2011b). GHG emissions of approximately 4,028 metric tons per year from construction are far below the comparative threshold. To give further context, GHGs from construction were compared to the 2011 emissions estimates for Washington (i.e., 41.9 million metric tons per year from the transportation sector and a statewide total of 91.7 million metric tons per year). Results indicate that the proposed Facility's GHG emissions from construction represent less than 0.01 percent of the transportation sector and less than 0.005 percent of the statewide total GHG emissions. For these reasons, construction emissions of GHGs from the proposed Facility alone would not be expected to significantly contribute to climate change. See Chapter 5 for additional discussion on GHGs and climate change, including a life-cycle analysis.

Table 3.2-11. Estimated Greenhouse Gas Emissions from Construction

Construction Activity	Emissions CO_2e (metric tons per year)
Scope 3 Emissions	
Unloading and office area (Area 200)	532
Storage area (Area 300)	641
Marine terminal (Area 400): land	21
Marine terminal (Area 400): water	1,180
Transfer pipelines (Area 500)	6
Boiler building (Area 600)	11
Rail infrastructure	21
Materials transport	1,500
Privately owned vehicles	116
Total Construction GHG Emissions	4,028
Comparative threshold	25,000

Sources: See Appendix G

CO_2e = carbon dioxide equivalent

Once operational, GHG emissions would result from the operation of stationary sources at the proposed Facility (i.e., boilers, MVCUs, component leaks, tanks, and fire pumps). They would meet the definition of Scope 1 emissions. In addition to Scope 1 emissions, the proposed Facility would consume purchased electricity for its operations, which is categorized as a Scope 2 emission. The operation of rail and vessel engines onsite and the transport of crude oil to and from the proposed Facility are categorized as Scope 3 emissions. For rail, the emissions were quantified using specific inter-Washington rail routes. For vessels, these emissions were quantified for roundtrips from the 3-nmi boundary for Washington to the Facility berths.

Table 3.2-12 summarizes these Scope 1, Scope 2, and Scope 3 GHG emissions on an annual basis. For comparative purposes, the estimated combined total GHG emissions are analyzed against the 25,000-metric-ton-per-year Ecology guidance threshold (Ecology 2011b). Direct and indirect operational emissions of approximately 512,350 metric tons per year are above the 25,000-metric-ton-per-year comparative threshold and, therefore, would trigger mitigation requirements pursuant to the guidance. To give further context, GHGs from operations were compared to the 2011 emissions estimates for Washington (i.e., 41.9 million metric tons per year from the transportation sector and a statewide total of 91.7 million metric tons per year). Results indicate that the proposed Facility's GHG emissions from operations represent approximately 1.2 percent of the transportation sector and approximately 0.5 percent of the statewide total GHG emissions.

Table 3.2-12. Estimated Greenhouse Gas Emissions from Facility Operations, including Mobile and Stationary Sources

Operational Activity	Annual Emissions CO_2e (metric tons per year)
Scope 1 Emissions	
Estimated Natural Gas Consumption	63,131
Stationary Source Operations Not Using Natural Gas	52,299
Total Scope 1 Operations GHG Emissions	115,430
Scope 2 Emissions	
Estimated Electricity Purchase/Consumption	196,616
Total Scope 2 GHG Emissions	196,616
Scope 3 Emissions	
Rail Crude Delivery (transiting within Washington)[a]	135,990
Vessel Crude Transport (transiting within Washington's 3-nmi boundary)[b]	18,248
Onsite Mobile Source Operations (Rail, Vessel, Tugs, Privately Owned Vehicles)[c, d]	10,827
Total Scope 3 Transportation GHG Emissions	200,304
Total Operational GHG Emissions	512,350
Comparative Threshold	25,000

Sources: See Appendix G

Notes:

a Transiting emissions are for loaded inbound trains only

b Vessel transit operations are assumed to occur between the proposed Facility and Washington's 3-nmi boundary

c Onsite vessel activities include maneuvering with tugs and hoteling with boilers

d Commuting staff emissions were estimated based on 532 daily trips (Kittelson Associates 2014)

CO_2e = carbon dioxide equivalent, GHG = greenhouse gas

In accordance with Ecology guidance (Ecology 2011b), a proposal would be presumed "not significant" for GHG emissions in the event that emissions exceed 25,000 metric tons per year but mitigation measures reduce such emissions by approximately 11 percent. Washington State law requires that new fossil-fueled thermal electric generating facilities provide mitigation of CO_2 emissions under WAC 463-80, requiring a 12 percent reduction of a project's total CO_2 emissions over 20 years of operation. WAC 463-80-060 specifies mitigation plan options, including an option for payment to a third party. While the legal requirement to comply with WAC 463-80 does not apply to the proposed Facility, the Applicant has voluntarily committed to implementing these mitigation requirements based on CO_2e emissions from stationary source operations. The obligation would be met through coordination with Ecology and payment to the Climate Trust at a level commensurate with a 12 percent stationary source reduction.

As shown in Table 3.2-13, the combined lifetime (20-year) GHG emissions of the proposed Facility are 6,457,455 metric tons of CO_2e. An additional 3,789,540 metric tons of CO_2e are estimated from the transportation of crude oil to and from the proposed Facility.

Table 3.2-13. Annual Estimated Greenhouse Gas Operational Emissions Over Project Lifespan (20 Years)

Operational Activity	CO_2e (metric tons)
Scope 1 Emissions	
Stationary Source Operations Consuming Natural Gas	1,262,620
Stationary Source Operations Not Consuming Natural Gas	1,045,980
20-Year Total Scope 1 Emissions	2,308,600
Scope 2 Emissions	
Estimated Electricity Purchase/Consumption	3,932,315
20-Year Total Scope 2 Emissions	3,932,315
Scope 3 Facility Emissions	
Onsite Mobile Source Operation (rail, vessel, commuting staff)	216,540
20-Year Total Scope 3 Facility Emissions	216,540
20-Year Total Scope 1 through 3 Facility Emissions	6,457,455
Scope 3 Offsite Emissions	
Rail Crude Delivery (transiting within Washington)	3,424,580
Vessel Transport (transiting from Facility to Washington's 3-nmi boundary)	364,960
20-Year Total Scope 3 Offsite Emissions	3,789,540
20-Year Total Operational GHG Emissions	10,246,995

Source: See Appendix G
CO_2e = carbon dioxide equivalent, GHG = greenhouse gas

3.2.4.5 Climate Change

GHG emissions increase the greenhouse effect and cause the Earth's surface temperature to rise. The consequences of climate change in the Pacific Northwest would be associated with warmer temperatures, greater precipitation, and a shift in winter precipitation type from snow to rain. Such consequences include (Hamlet 2001):

- Reduced snowpacks
- Higher winter streamflows
- Increased flood potential

- Lower summer flows
- Earlier snowmelt-generated peak flows

The proposed Facility would be located in the Columbia River Basin. This basin has historically been a mixed rain-snow watershed. Climate change projections indicate that the watershed will migrate over time to a rain-dominant watershed. Watersheds that shift from mixed rain-snow conditions to rain dominant will experience less snow and more rain during the winter months, resulting in increased winter flow and lower summer streamflow since a buildup of snow (i.e., snowpack) would not occur during the winter.

Indirect effects on hydropower production (i.e., reduced generation) related to climate change may result from adaptation to rain-dominant conditions such as flood control operations, instream flow augmentation, and possible renegotiation of the Columbia River Treaty (Ecology 2011c).

Projected increases in flooding related to climate change may pose greater risks to developed areas—floodplains, urban areas, roads, stormwater systems, and other infrastructure at water crossings such as pipelines, bridges, and culverts (Dalton et al. 2013). Extreme precipitation events have the potential to cause localized flooding due partly to inadequate capacity of storm drain systems. Extreme events may damage or cause failure of dam spillways (Oregon Department of Land Conservation and Development 2010). Heavy rainfall can also saturate soils and increase risks of landslides, particularly in areas with unstable slopes or disturbed vegetation. Landslides can have damaging impacts to communities, roadways, and other infrastructure (Oregon Department of Land Conservation and Development 2010). Impacts to transportation systems can impose delays on the movement of goods and the traveling public (Walker et al. 2011).

3.2.5 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to air quality from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to air quality beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. These facilities would likely involve construction of some sort, resulting in similar types of impacts to air quality as the proposed Facility, including increases of ambient air pollution concentrations, construction CO emissions, and construction emissions of other criteria pollutants. A different facility would also likely result in operational stationary source emissions of criteria pollutant emissions. A facility that used the rail infrastructure and/or berthing areas would have mobile source emissions. The quantity of GHG emissions would depend on the type of facility constructed at the available areas at Terminals 4 and 5. However, it is not feasible to quantify air quality emissions under the No Action Alternative since it is not known which type of facility would be constructed.

3.2.6 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to air quality in this Draft EIS. EFSEC has not identified any additional mitigation measures to reduce impacts to air quality. However, EFSEC will further assess the adequacy of Applicant-proposed air quality construction impact reduction measures during review of the Notice of Construction permit[7] application. Furthermore, the mitigation measures identified in Section 3.14.5 to reduce vehicular delays from gate downtime at at-grade crossings would also reduce emissions from idling vehicles.

3.2.7 Significant Unavoidable Adverse Impacts

Emissions of criteria pollutants from stationary sources and onsite and near-site mobile sources during operation and maintenance, while below the levels allowed by ambient air quality standards, could result in moderate air quality impacts to and near the proposed Facility site, including at the JWC.

Emissions of DPM from stationary sources and onsite and near-site mobile sources during operation and maintenance could result in moderate air quality impacts at nearby commercial and industrial receptors, including staff at the JWC and other worksites in close proximity to the proposed Facility.

7 The Notice of Construction permit is required for installation of a new source of air pollution or for modification of an existing source of air pollution.

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3.3 WATER RESOURCES

This section describes the water resources currently present within and in close proximity to the proposed Facility site and along the rail and vessel transportation corridors that would be used to transport crude oil to and from the proposed Facility. This section identifies the nature, magnitude, duration, and intensity of impacts to water resources resulting from the construction, operation and maintenance, and decommissioning of the proposed Facility, as well as potential impacts to water resources along rail and vessel transportation corridors. Impacts considered primarily include those associated with sediment disturbance, flood risk, and water contamination of surface and groundwater from equipment or vessels.

Water resources included in this analysis are as follows:

- **Streams/Waterbodies.** The Columbia River, its tributaries, and other waterbodies in the rail and vessel corridors provide important resources for commerce, transportation, agriculture, recreation, and wildlife. These waterbodies also provide hydroelectric power, irrigation, and flood control.
- **Surface Water Quality.** Surface water is used for a wide range of purposes, including wildlife habitat, drinking water, industrial process water, irrigation, hydropower generation, and recreational activities. Changes in surface water quality, such as high concentrations of toxic compounds, increased temperature, or high turbidity can impact these uses.
- **Groundwater Quality.** Groundwater is used for drinking water and domestic/municipal, agricultural, and industrial purposes. Changes in quality of groundwater, such as high concentrations of toxic compounds or high turbidity, can impact these uses.
- **Stormwater Runoff/Surface Water Drainage.** Stormwater runoff occurs in areas with impervious surfaces (e.g., concrete or asphalt) and can be treated and monitored to reduce sediment and pollution input into nearby waterways.
- **Surface or Groundwater Water Supplies.** Surface water is collected through dams, diversions, or pump systems from waterbodies along the rail and vessel corridors. Public and private groundwater pumping for drinking water, irrigation, and various commercial and industrial uses occurs near the proposed Facility site and along the rail and vessel corridors.
- **Floodplains.** Floodplains can provide resources for diverse ecosystems as well as beneficial agricultural land. They also represent areas with various likelihoods of experiencing flooding (e.g., 100- and 500-year floodplains).
- **Wetlands.** Wetlands provide numerous beneficial functions such as flood control, shoreline stability, and storm protection, and serve as high-quality habitat for a diverse array of plant and wildlife species.

Measures to avoid or minimize adverse impacts to water resources proposed by the Applicant are described and additional mitigation to protect water resources has been identified by EFSEC. Significant unavoidable adverse impacts that cannot be mitigated are summarized.

3.3.1 Methods of Analysis

The study areas used to describe the affected environment and assess impacts to water resources are based on the same general study areas described in Section 3.0. However, because the topic of water resources covers several related but separate subtopics, the study areas have been further subdivided by water resource component, as described in Table 3.3-1. These study areas include water resources that could potentially be affected by a major oil spill, fire, or explosion.

Table 3.3-1. Study Areas for Water Resource Components

Water Resources Component	Proposed Facility	Rail Corridor and Rail-Columbia River Corridor[2]	Vessel Corridor
Streams/Waterbodies	Columbia River in the vicinity of the proposed Facility, including the area extending approximately 0.25 mile downstream.	Streams and waterbodies within 0.5 mile on either side of the proposed rail route from Williston, North Dakota, to the Port, including the Columbia River and the area 0.25 mile landward between Kennewick/ Pasco and the Port.	The Lower Columbia River from the marine terminal to the mouth of the Columbia River, including waterbodies within the area 0.25 mile landward from the river.
Surface Water Quality	Columbia River in the vicinity of the proposed Facility, including the area extending approximately 0.25 mile downstream.	Surface waterbodies crossed by and within 0.5 mile on either side of the proposed rail route from Williston, North Dakota, to the Port, including the Columbia River and the area 0.25 mile landward between Kennewick/Pasco and the Port.	The Lower Columbia River from the marine terminal to the mouth of the Columbia River, including waterbodies within the area 0.25 mile landward from the river. Marine waters beyond the Columbia River mouth.
Groundwater Quality	Portland Basin of the Columbia River floodplain; Troutdale Sole Source Aquifer.	Aquifers crossed by the proposed rail route, including Spokane Valley-Rathdrum Prairie Sole Source Aquifer.	Groundwater in connection to the Lower Columbia River.
Surface or Groundwater Water Supplies	Port of Vancouver; City of Vancouver service area; Portland Basin; Troutdale Aquifer System.	Surface water sources, aquifers, and well protection zones within 0.5 mile on either side of the proposed rail route and within 0.25 mile landward from the Columbia River between Kennewick/Pasco and the Port.	Surface water sources, aquifers, and well protection zones within 0.25 mile landward from the Lower Columbia River.
Floodplains	The portions of the proposed Facility site located within the 500-year floodplain.	100-year floodplains within 0.5 mile on either side of the proposed rail route, and within 0.25 mile landward from the Columbia River between Kennewick/Pasco and the Port.	100-year floodplain within 0.25 mile landward from the Lower Columbia River.
Wetlands	Wetlands on the proposed Facility site (or within 300 feet of the site).[1]	Wetlands within 0.5 mile on either side of the proposed rail route, and within 0.25 mile landward from the Columbia River between Kennewick/Pasco and the Port.	Wetlands within 0.25 mile landward from the Lower Columbia River.

Notes:

1 The 300-foot distance was established based on the wetland buffers widths that are specified in the City's Critical Areas Protection Ordinance (Vancouver Municipal Code [VMC] Chapter 20.740). Buffer widths are based on wetland category, wetland characteristics, and land use intensity, and extend a distance of 25 feet for low-quality wetlands with low land use intensity and up to 300 feet for high-quality wetlands with high habitat functions. Buffer widths do not apply if the buffer area is completely functionally separated from a wetland and does not protect the wetland from adverse impacts.

2 See Figure 3.0-2 for the geographic limits of the rail-Columbia River corridor.

Quantitative methods to analyze impacts to water resource components were used whenever adequate data sets were available. The primary sources of data that were used to analyze each water resource component are identified in Table 3.3-2.

Quantitative modeling performed by the Applicant, particularly for hydrology and stormwater quality, and Applicant-performed wetland surveys were reviewed by EFSEC's consultant and incorporated into this analysis as appropriate. Additional geographic information system (GIS) analysis of the expanded data set includes the number and lengths of streams crossed, number of surface diversions and groundwater wells, areas of surface and groundwater supply protection zones, and acres of floodplains and acres of wetlands within rail and vessel corridors. Natural hydrologic, hydraulic, geomorphic, and biogeochemical processes, as well as regulatory requirements and operating practices, have been considered in selecting information for the affected environment.

Table 3.3-2. Water Resources Data Sources

Water Resources Component	Public Agencies and Data Sets	Other Published Sources	Applicant-Prepared Analyses
Erosion and Sedimentation	USCG; USGS; USACE; WDNR; Ecology (VEAT)	Scientific literature on hydraulics and sediment/erosion on Lower Columbia River and vessel-wake erosion; Lower Columbia River Estuary Partnership 2010	BergerABAM 2014 (Preliminary Draft EIS); Application for Site Certification
Surface Water Quality	USGS; Port; Ecology Discharge Monitoring Reports; City requirements and records; NOAA	Lower Columbia River Estuary Partnership 2010; CRC group data (CRC 2011); RIFS and Final Supplemental CAP (Anchor Environmental 2008)	BergerABAM 2014 (Preliminary Draft EIS); NPDES application and engineering reports; SPCC, SWPPP, OSCP
Stormwater Runoff/ Surface Water Drainage	Port; Ecology permits and discharge monitoring records; City requirements and records	None	BergerABAM 2014 (Preliminary Draft EIS); NPDES application and engineering reports; SPCC, SWPPP, OSCP
Groundwater Quality	Port; Ecology; EPA; City requirements and records; USGS; NOAA	RIFS and Final Supplemental CAP (Anchor Environmental 2008)	BergerABAM 2014 (Preliminary Draft EIS); SPCC, SWPPP, OSCP
Surface or Groundwater Water Supplies	Port, City, CPU; Clark County; State of Washington and State of Oregon; USGS Groundwater Atlas (USGS 1994)	None	BergerABAM 2014 (Preliminary Draft EIS)
Flood Hazards	FEMA FIRM studies and maps; Clark County; City	None	BergerABAM 2014 (Preliminary Draft EIS)
Wetlands	USACE; USFWS National Wetlands Inventory (USFWS 1989); Ecology	CRWMB	BergerABAM 2014 (Preliminary Draft EIS); wetland delineation/JARPA

CAP = corrective action plan, CRC = Columbia River Crossing, CPU = Clark Public Utilities, CRWMB = Columbia River Wetland Mitigation Bank, Ecology = Washington State Department of Ecology, EIS = Environmental Impact Statement, EPA = US Environmental Protection Agency, FEMA FIRM = Federal Emergency Management Agency Flood Insurance Rate Map, JARPA = Joint Aquatic Resources Permit Application, NOAA = National Oceanic and Atmospheric Administration, NPDES = National Pollutant Discharge Elimination System, OSCP = Oil Spill Contingency Plan, RIFS = Remedial Investigation Feasibility Study, SPCC = Spill Prevention, Control, and Countermeasure, SWPPP = Stormwater Pollution Prevention Plan, USACE = US Army Corps of Engineers, USFWS = US Fish and Wildlife Service, USCG = US Coast Guard, USGS = US Geological Survey, VEAT = Vessel Entries and Transits, WDNR = Washington State Department of Natural Resources

3.3.2 Affected Environment

3.3.2.1 Proposed Facility

Surface Water

Watersheds and Surface Water Features

The proposed Facility would be located within the Salmon-Washougal watershed, in Water Resource Inventory Area (WRIA) 28. This watershed extends along the north bank of the Columbia River from Bonneville Dam to Whipple Creek, and is one of the most populated watersheds in western Washington. While it contains large urban and industrial areas, it also includes three National Wildlife Refuges (NWRs) along the Columbia River. The Washougal River drains the eastern portions of the watershed, entering the Columbia River between Washougal and Camas. Salmon Creek drains the north and west portions of the watershed, and portions of the City, and enters the Columbia River upstream of Ridgefield.

No surface water resources lie within the proposed Facility's footprint within Port property, but the adjacent wetland areas to the northeast drain to Vancouver Lake. The proposed marine terminal modifications would occur on the north bank and within the Columbia River at existing dock facilities.

The Columbia River and its tributaries constitute the dominant river system in the Pacific Northwest, and it is the fourth largest river in the United States based on discharge. The mean annual flow measured for the Columbia River at The Dalles Dam is approximately 190,000 cubic feet per second (cfs). The river's annual discharge rate fluctuates with precipitation and ranges between 120,000 cfs in a low water year to 260,000 cfs in a high water year (Ecology 2014). The Columbia River is an important resource for commerce, agriculture, recreation, and natural resources, and is a regional landmark. The proposed Facility would be located at approximately River Mile (RM) 106 upstream of the mouth at the Pacific Ocean, within the tidally influenced reach downstream of Bonneville Dam (at RM 146.2). In the vicinity of the Port, the mean daily tidal range is 2.57 feet (NOAA 2015a).

The north bank of the Columbia River in the vicinity of the Port has sections of sand and gravel beaches, along with sections of riprap protection, and includes engineered stormwater outfall facilities that discharge from the Port's system. The main river has been deepened to maintain the navigational corridor and the channel margins have been dredged to maintain ship access to existing docks at the Port. The immediate opposite bank of the river is the northeast side of Hayden Island, and consists of sand and gravel beaches (NWAC 2003).

Pilings and piers are located below the OHWM and extend into the riverbed at the existing marine terminals of the Port, and at adjacent facilities upstream and downstream along the north bank of the Columbia River.

Surface Water Quality

Surface water quality in the Columbia River is influenced by legacy and ongoing point and nonpoint sources of pollution, the quality of contributing shallow groundwater, natural geochemistry, tidal currents, and weather-driven waves. The Columbia River has elevated levels of contaminants.

The Lower Columbia Estuary Partnership, established in 1995, is one of 28 EPA National Estuary Programs working to improve the health of the Lower Columbia River and Estuary, advancing science, understanding restoration, and monitoring water quality and ecosystem conditions. The EPA, other federal agencies, states, tribes, and nonprofit partners established the Columbia River Toxics Reduction Working Group in 2005 to share information, coordinate activities, and develop strategies for identifying and reducing toxics in the Columbia River Basin. This group completed a focused toxics report in 2009 (EPA 2015), which identified legacy dichlorodiphenyltrichloroethane (DDT) (and breakdown products) and PCBs, polycyclic aromatic hydrocarbons (PAHs), and polybrominated diphenyl ethers (PBDEs). However, many other contaminants occur, including arsenic, mercury, dioxins, radionuclides, lead, pesticides, industrial chemicals, and pharmaceuticals. Ongoing coordination and collaboration regarding toxics reduction initiatives, research, and monitoring are necessary to continue improving the water quality and ecosystem services.

The Columbia River near the proposed Facility is listed as impaired under Clean Water Act (CWA) Section 303(d) by the State of Washington for failing to meet water quality standards for toxics (PCBs), eutrophication (dissolved oxygen), and temperature. The 303(d) listing for the Columbia River by the State of Oregon is for toxics (PCBs, PAHs, DDT/dichlorodiphenyldichloroethylene/arsenic), eutrophication (dissolved oxygen), and temperature.

The EPA approved a total maximum daily load (TMDL) to limit dioxins discharged to the Columbia River in 1991 (EPA 1991), allocating loads to pulp mills and other sources, including future growth. An established TMDL on the Lower Columbia River for elevated total dissolved gas (Ecology and ODEQ 2002) addresses the entire mainstem from the mouth at the Pacific Ocean to the confluence with the Snake River. The TMDL sets a total dissolved gas load capacity for excess pressure related to spill events at hydroelectric projects and allocates loads for each dam. These TMDL allocations would not be affected by, nor would they affect, the Proposed Project.

Surface Water Use

Surface water on the Port is not collected or diverted for beneficial uses.

Stormwater Drainage

The approximately 47.4-acre proposed Facility includes areas in three distinct Port stormwater drainage basins with separate discharges (Table 3.3-3 and Figure 3.3-1). The site is relatively flat, ranging from an upland elevation of 39± feet (North American Vertical Datum [NAVD] 88) to a top of bank elevation of 30± feet. The site consists of fill and soils that are moderately to well drained, with land cover dominated by impervious surfaces (95.7 percent), including compacted soils, asphalt, and miscellaneous materials. Stormwater from the 91-acre Terminal 5 drainage basin flows through a series of 24-inch-diameter pipelines to a pump station and is conveyed to two water quality treatment lagoons prior to discharging to the Columbia River via an existing 36-inch Port outfall (T50) (Figure 3.3-2). This system includes overflow provisions for high flows or pump station failure and is permitted under an existing Municipal Stormwater Permit (#WAR045201) (BergerABAM 2015a). A Master Stormwater System Plan was prepared for the entire Terminal 5 area in 2013 (HDR 2013). The stormwater conveyance system was sized assuming the entire 91-acre drainage basin is fully impervious. This plan states that the conveyance system would function as intended to accommodate 100-year storm events.

Stormwater from the 250-acre Terminal 4 drainage basin flows through a series of 36-inch pipelines to the recently improved Terminal 4 water quality pond (Figure 3.3-3), prior to discharging to the Columbia River through an existing 60-inch Port outfall (T40) permitted under an Industrial Stormwater General Permit (#WAR000424) (BergerABAM 2015a). Stormwater generated from the marine terminal portion of Terminal 4 discharges to existing treatment and infiltration swales installed as part of the Port’s Columbia Gateway – Phase 1 project. A total of 25 acres serving multiple Port tenants drain through biofiltration swales and into two infiltration swales (Figure 3.3-4). This existing stormwater system has no surface outfall, but discharges via seepage through the swales and overland flow along the small area at the dock and on the bank on the river side of the swales (BergerABAM 2015a).

Climate in the vicinity is characterized by wet, mild winters and dry summers, as is typical for areas in proximity to the Pacific Ocean and between the Cascade and Coast Ranges of Oregon and Washington. Historical weather data for the Vancouver 4 NNE agricultural meteorological station 4 miles northeast of the site indicate long-term average annual precipitation of 39.6 inches of rainfall and 6.5 inches of snow, received primarily during winter (NOAA 2015b). The estimated precipitation intensity associated with design storms listed in the NOAA Atlas ranges from 2.4 inches for the 2-year, 24-hour storm to 4.3 inches for the 100-year, 24-hour storm. Stormwater peak runoff flows from the site under existing conditions range from 15.68 cfs for the 2-year storm to 38.02 cfs for the 100-year storm (BergerABAM 2015a).

Table 3.3-3. Facility Areas within Existing Port Stormwater Drainage Basins

Port Stormwater Basin	Discharge to Columbia River	Facility Areas to be Included
Terminal 5 Stormwater System	• 36-inch outfall (T50) • Overflow outfall	• Unloading and Office Area (Area 200) • Portion of Transfer Pipelines (Area 500) • Boiler Building (Area 600) • Rail Infrastructure
Terminal 4 Stormwater System	• 60-inch outfall (T40)	• Storage Area (Area 300) • Portion of Transfer Pipelines (Area 500)
Marine Terminal Infiltration Swales	• Infiltration seepage from swales • Surface/sheet flow along top of bank	• Marine Terminal (Area 400) • Portion of Transfer Pipelines (Area 500)
Port General Use Area	• Via Terminals 4 and 5 outfalls	• Rail improvements located within the Port's master plan rail corridor • Portion of Transfer Pipelines (Area 500) • Nonpollution-generating area on the northern side of the railcar unloading structure

Source: BergerABAM 2015a

Stormwater Water Quality

Discharge monitoring reports for samples taken at these outfalls show benchmark exceedances for copper and zinc over the few years of data (Figure 3.3-5; Ecology 2015). The three available monitoring locations associated with the permit (#WAR000424) are T4M at Terminal 4, T2M at Terminal 2, and MCB4[1] at Terminal 4. Figure 3.3-5 shows recent monitoring data from all three monitoring locations at the Port. Discharge from this portion of the proposed Facility would flow through outfall T40 (T4M).[2]

1 Data from the MCB4 monitoring station were collected until 2010, when the sampling point changed to T4M.

2 Outfall numbers differ in the *Discharge Monitoring Report* data (BergerABAM 2015). Ecology's *Discharge Monitoring Report* data names the Terminal 4 outfall as T4M, rather than T40.

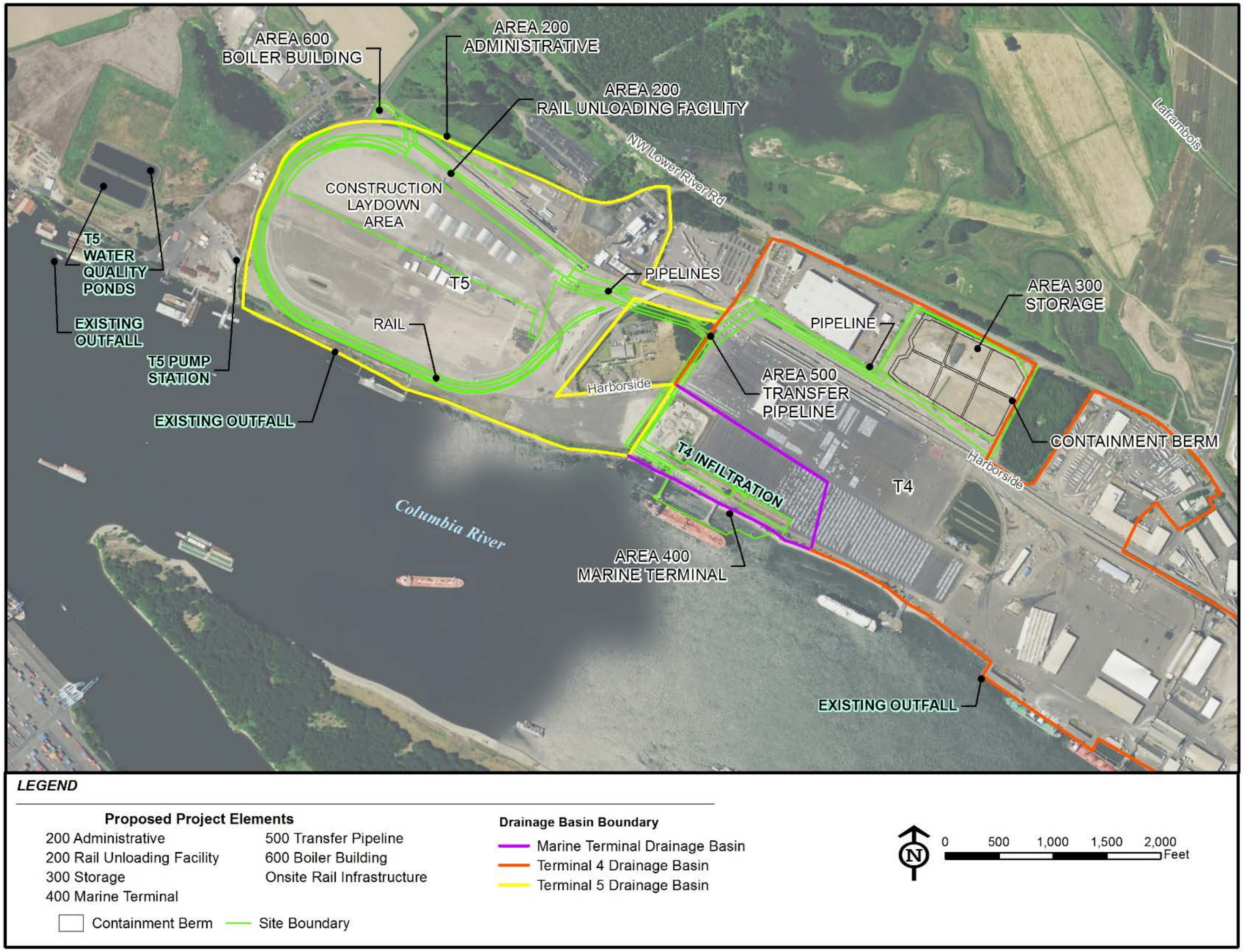

Figure 3.3-1. Port Stormwater Drainage Basins that Include Proposed Facility Areas

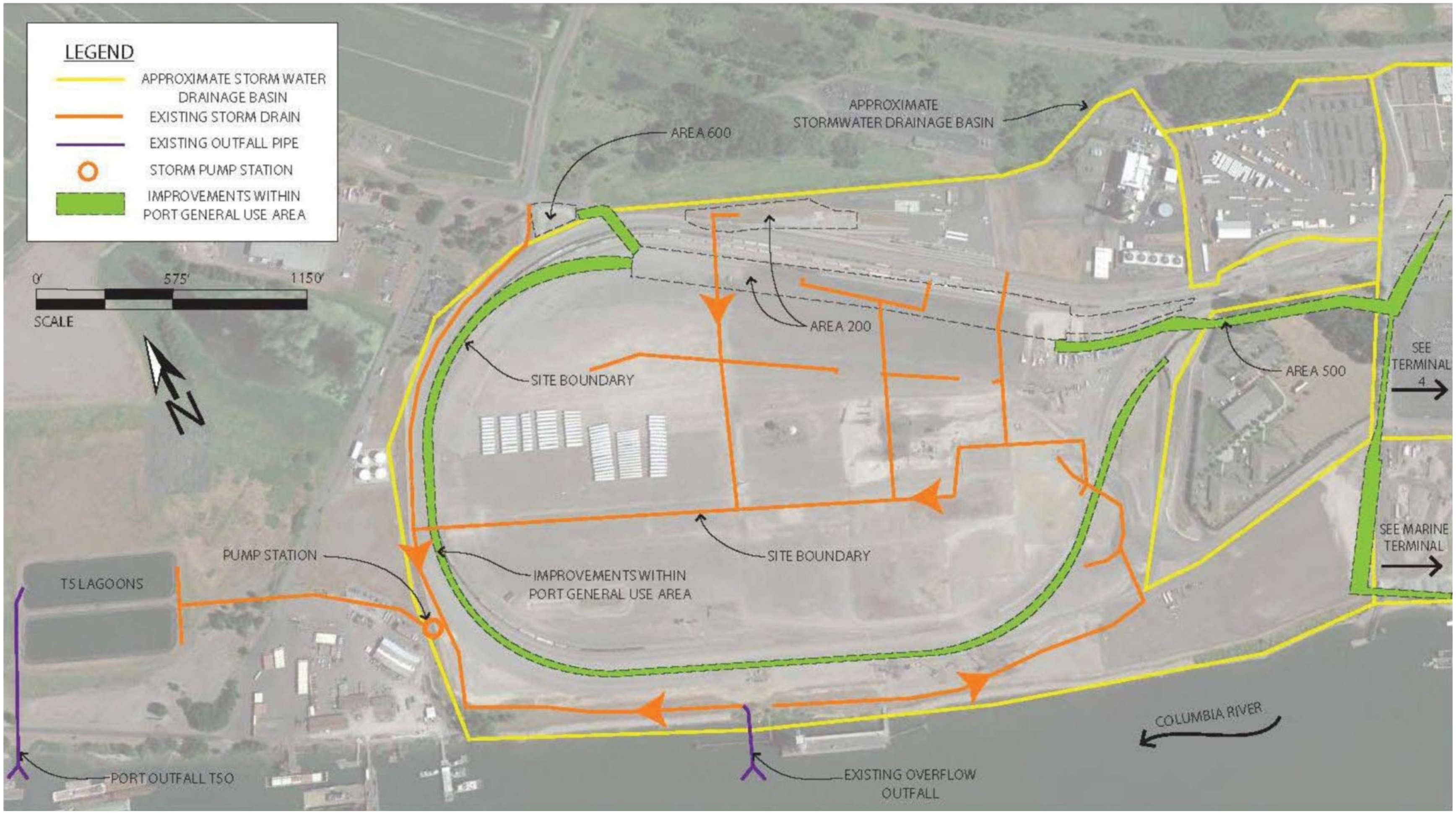

Figure 3.3-2. Existing Terminal 5 Stormwater System

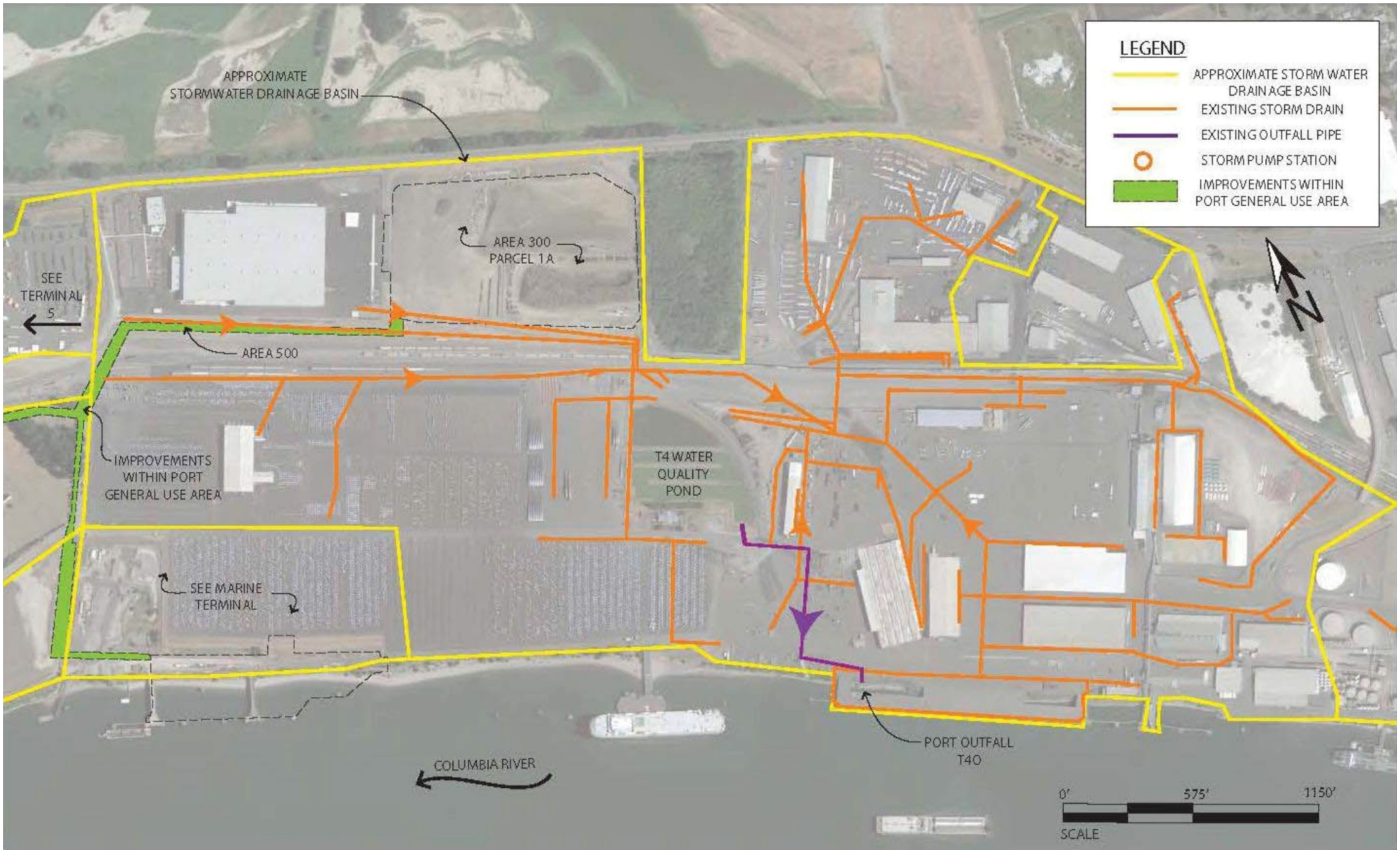

Figure 3.3-3. Existing Terminal 4 Stormwater System

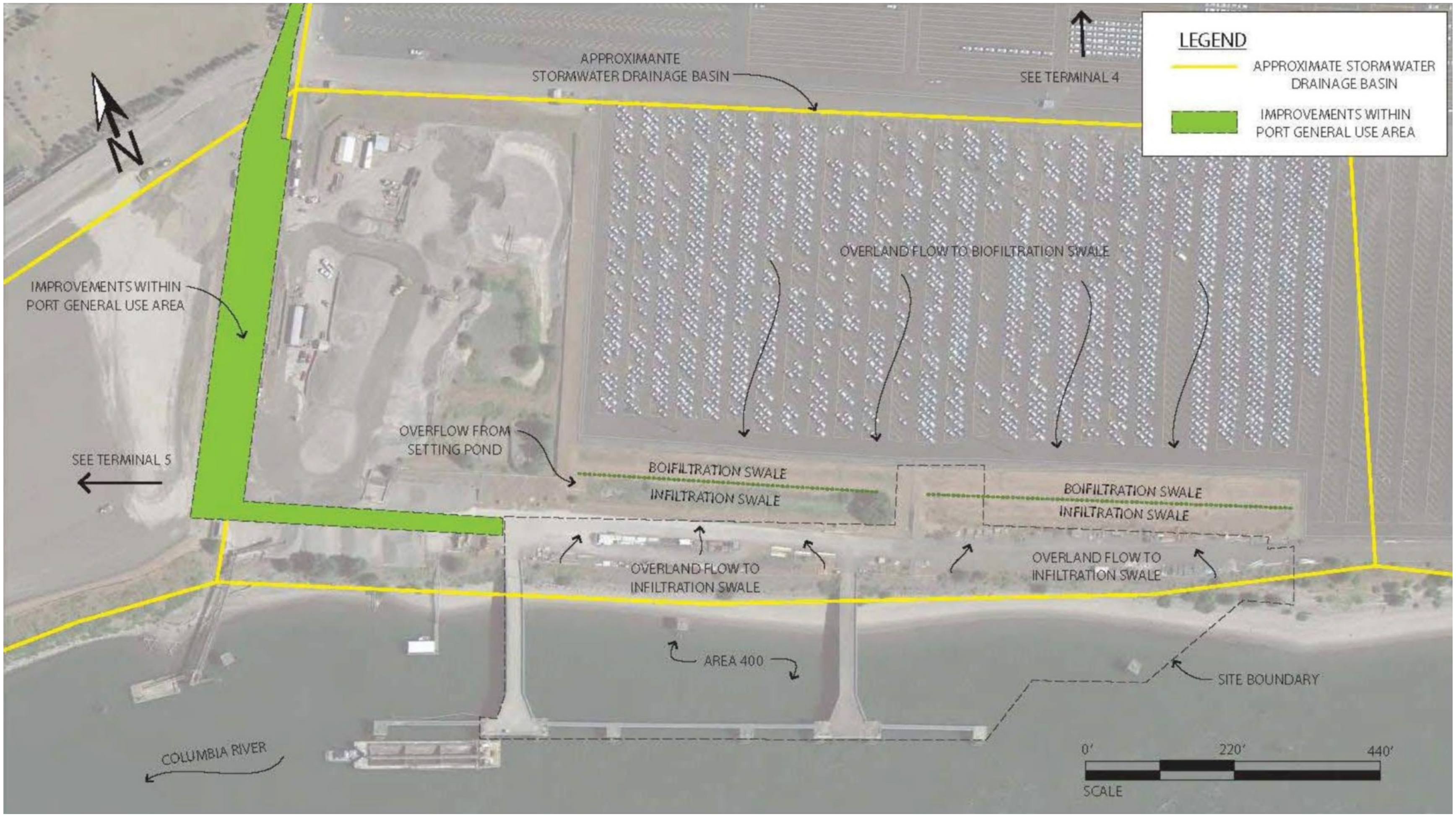

Figure 3.3-4. Existing Terminal 4 Marine Terminal Infiltration Swales

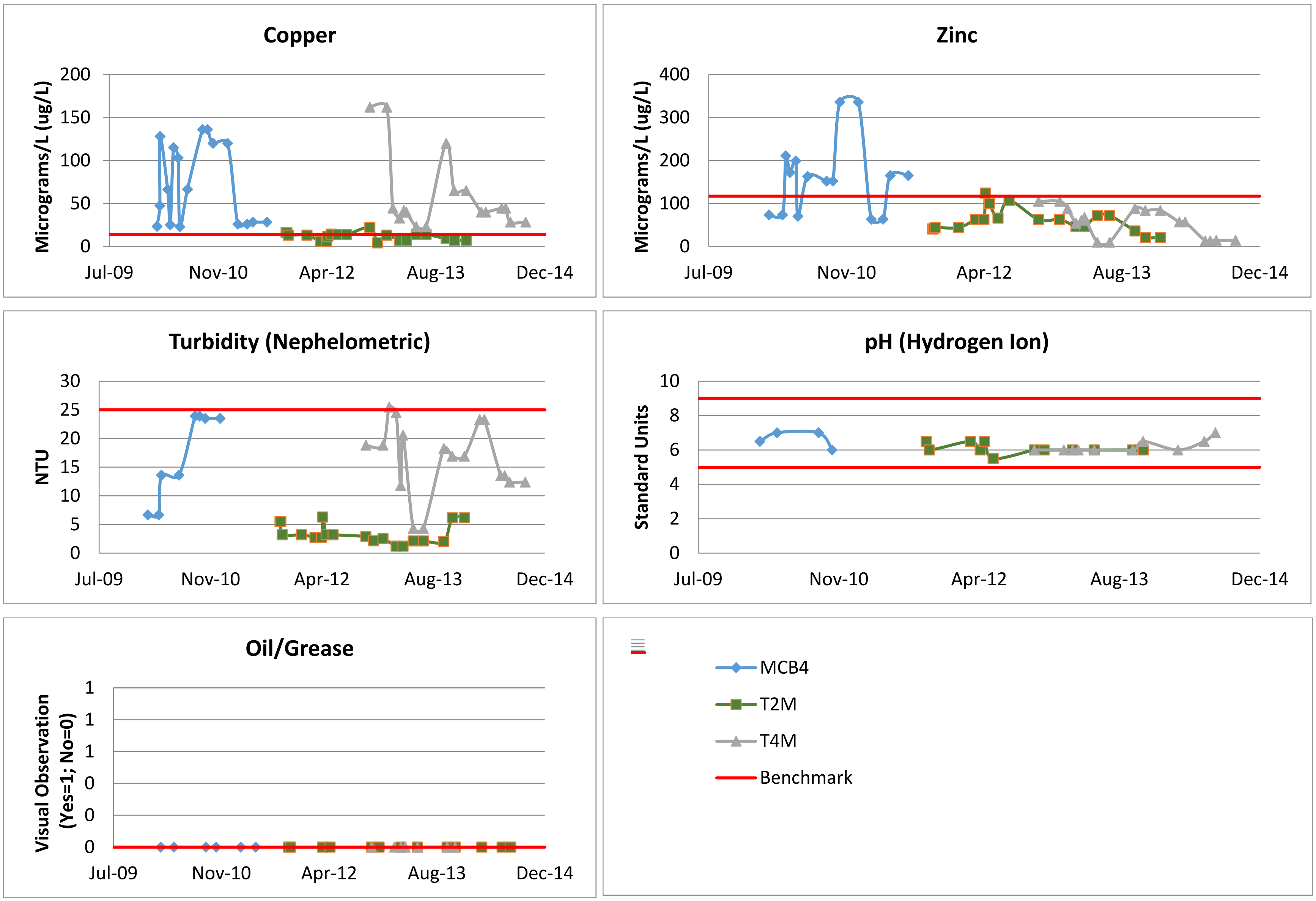

Figure 3.3-5. Recent Port Industrial Stormwater Permit Monitoring Data (WAR000424)

Groundwater

Hydrogeology

The proposed Facility is within the Portland Basin geologic structure between the Cascade Range and the Tualatin Mountains in the Coast Range (see Section 3.1). Deposits in the Portland Basin include eight hydrogeologic units (Swanson et al. 1993, McFarland and Morgan 1996) (Figure 3.3-6). The Sandy River Mudstone and the Troutdale Formation are the oldest sediments overlying the basaltic and marine sedimentary bedrock units and constitute the lower sedimentary subsystem (Figure 3.3-6). Confining units isolate the lower Troutdale Formation aquifers from the upper system. The upper sedimentary subsystem includes the Troutdale Gravel Aquifer (TGA), deposits from major flooding of the Columbia River (Trimble 1963), and Quaternary alluvium. All of the upper sedimentary units are relatively unconsolidated with limited cementation, and form unconfined aquifers.

The Troutdale Aquifer System (TAS) consists of multiple aquifers within the upper and lower hydrogeologic system, including: Unconsolidated Sedimentary Aquifer (USA); TGA; Troutdale Sandstone Aquifer; and the Sand and Gravel Aquifer (FHWA et al. 2011). The USA and TGA are the most productive and accessible aquifers and contain the majority of water supply wells for drinking water (~90 percent for the wells that tap them). The USA has very high median hydraulic conductivity (200 feet/day), ranging from 0.03 to 70,000 feet per day. In comparison, median hydraulic conductivity in the underlying TGA, composed of partially cemented sandy conglomerate, is 7 feet per day. However, the TGA has also been and continues to be a very productive aquifer in the TAS.

The site investigations in the western portion of the proposed Facility conducted between 1987 and 2004, (Anchor Environmental 2008) further described characteristics within the USA:

- **Shallow Zone.** Contains dredge fill sand ranging in thickness from about 7 to 25 feet. Groundwater is seasonally present in this zone and may locally be perched above finer-grained materials in the Intermediate Zone. Many monitoring wells screened in this zone are dry in late summer and fall. The horizontal hydraulic conductivity in this zone ranges between 0.25 to 25 feet per day.
- **Intermediate Zone.** Contains Quaternary alluvium consisting of silt, fine sand, and clay extending from approximately 15 feet to 35 feet bgs. The top of this zone is the native ground surface present before dredge fill was placed over the area in the 1940s. In some locations, such as the East Landfill, this unit extends to a depth of 60 feet bgs. The horizontal hydraulic conductivity in this zone ranges between 0.0025 to 0.25 feet per day. Groundwater elevations suggest an east-west groundwater divide, with groundwater north of the divide flowing away from the Columbia River, perhaps due to pumping at cooling water supply wells for Clark Public Utilities' (CPU's) River Road Generating Plant (Anchor Environmental 2008).
- **Deep Zone.** Contains Quaternary alluvium consisting of fine to medium sand ranging from approximately 35 to 95 feet bgs (on average), although in the southern part of the study area, it extends as deep as 125 feet bgs. The horizontal hydraulic conductivity and groundwater divide is similar to the Intermediate Zone.
- **Aquifer Zone.** Contains unconsolidated sedimentary gravel aquifer with extremely high hydraulic conductivity, with an upper surface between 95 feet bgs in the northern portion of the study area to about 125 feet bgs in the southern area near the river. The Alcoa plant supply wells were screened in the Aquifer Zone, as were neighboring high-yield supply wells operated by CPU, the Port, and Great Western Malting Company. The horizontal hydraulic conductivity

ranges from approximately 2.5 to 25 feet per day.[3] Data collected during the investigation suggested that this zone may be gaining water from the Columbia River, which was attributed to pumping for cooling water at CPU's River Road Generating Plant.

Vertical communication between the Intermediate and Deep zones is relatively poor over much of the study area but fairly good in three wells (one well in the northern portion of the study area and two wells near the East Landfill) (Anchor Environmental 2008). Vertical hydraulic gradients suggest relatively good communication between the Deep and Aquifer zones in the USA, which is consistent with field conditions since both zones comprise coarse-grained materials. Across the study area, a downward gradient is present.

Groundwater Recharge, Levels, and Flow

Recharge to the unconfined upper aquifer of the TAS is primarily from infiltration and percolation of precipitation over the aquifer and its source watershed areas (Figure 3.3-7), along with infiltration from streams and rivers and shallow groundwater movement from the Columbia River under high river stage and/or inland pumping conditions.

Groundwater elevations in the unconfined units generally follow the topography, and the overall groundwater flow paths are from the northeast toward the southwest and the Columbia River, with variations controlled by topography, surface waterbodies, and well pumping. The recharge areas, hydraulic properties of the aquifer materials, and typical flow directions and gradients form the basis of the designated wellhead protection zones (Figure 3.3-8).

Depth to groundwater in the vicinity of the proposed Facility is typically shallow (depth bgs is 10 feet or less) to the northwest through the wetlands complex and margins of Lake Vancouver. Along the east margin of the Port, depth to groundwater increases from about 10 feet bgs to 30 feet bgs within a distance of approximately 0.5 mile (Clark County 2015). Groundwater levels at the Port fluctuate in response to seasonal precipitation, seasonal river levels, and daily tidal stage changes (GRI 2013), along with local groundwater pumping effects. Variations in the fill materials and natural alluvium can support local shallow, perched groundwater. Brief onsite monitoring (in the storage area [Area 300]) of shallow groundwater during summer 2013 demonstrated a very close relationship to the water surface elevation in the adjacent Columbia River and a depth bgs of around 12 feet (GRI 2013). Groundwater levels under the proposed Facility would be expected to be seasonally higher during peak runoff from the surface watershed recharge and high river stage, and to potentially reach the surface during major flood events.

3 The Remedial Investigation Feasibility Study (Anchor Environmental 2008) indicates that this estimate of hydraulic conductivity appears to be low, likely due to limitations of slug tests. Estimates of the aquifer in general, i.e., beyond the proposed Facility, indicate higher hydraulic conductivities.

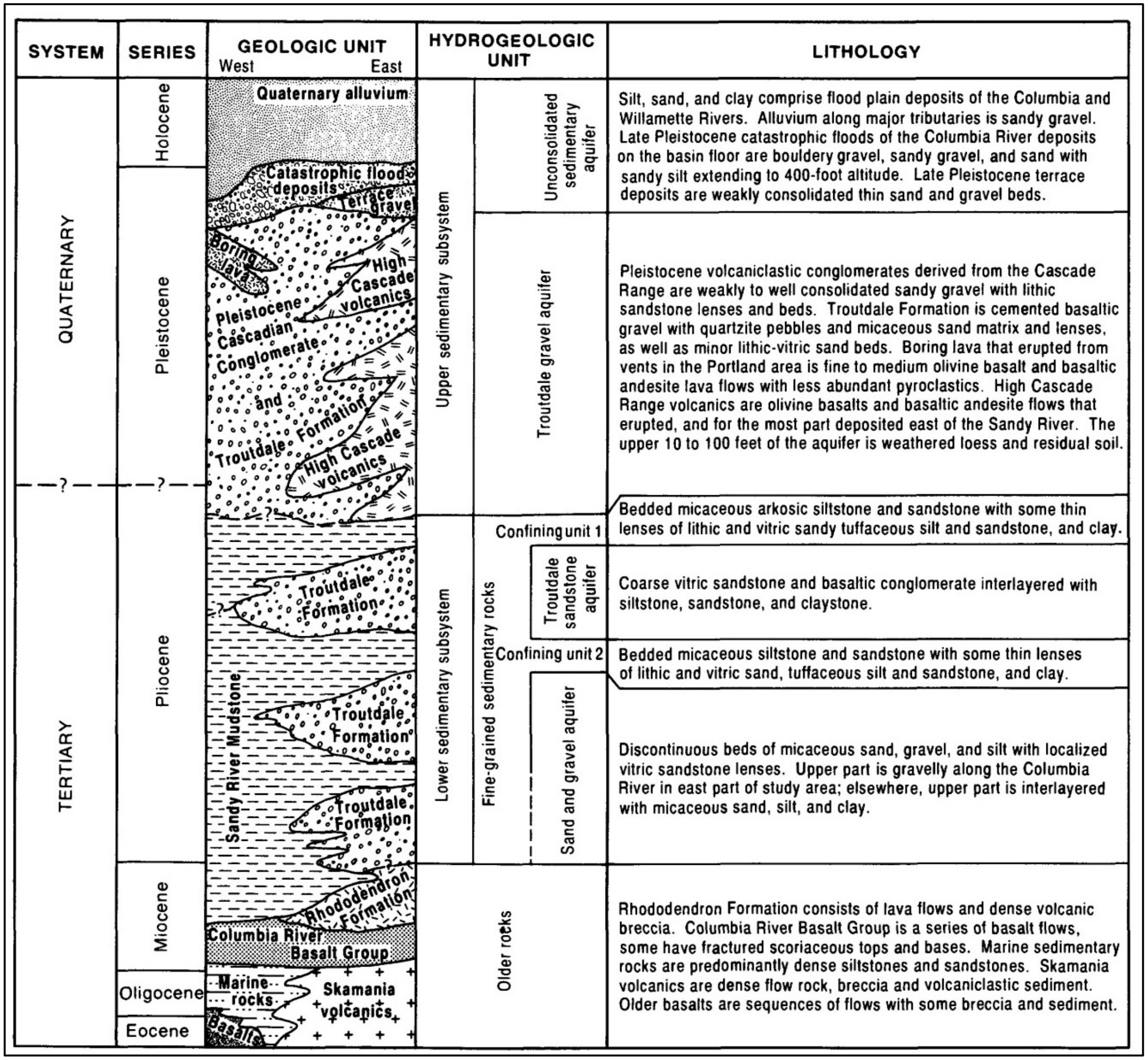

Figure 3.3-6. Geologic and Hydrogeologic Units in the Portland Basin

Source: Swanson et al. 1993

Note: An enlarged version of this figure is available in Appendix P.11.

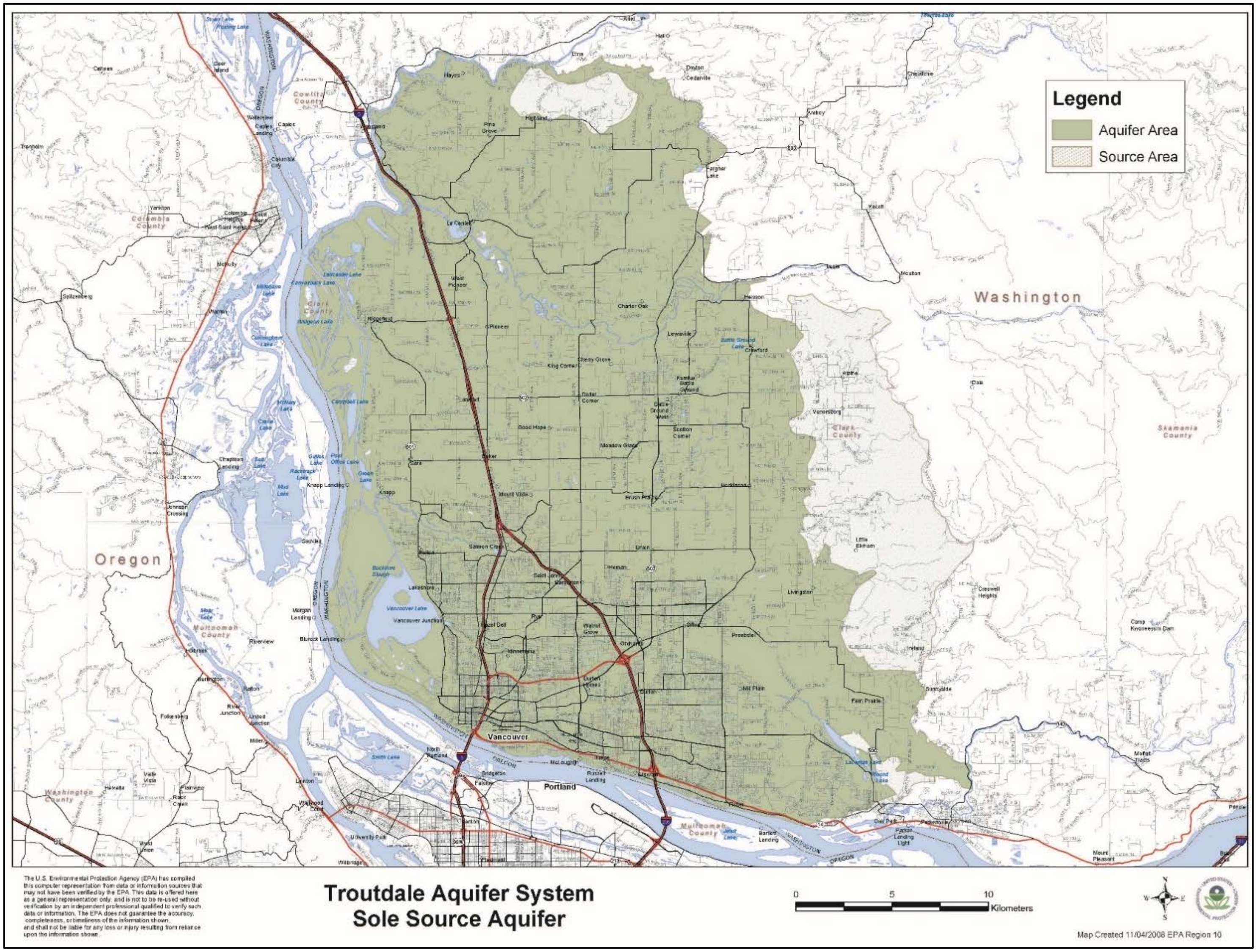

Figure 3.3-7. Troutdale Aquifer System—Sole Source Aquifer Area

Source: EPA 2014

Note: An enlarged version of this figure is available in Appendix P.11.

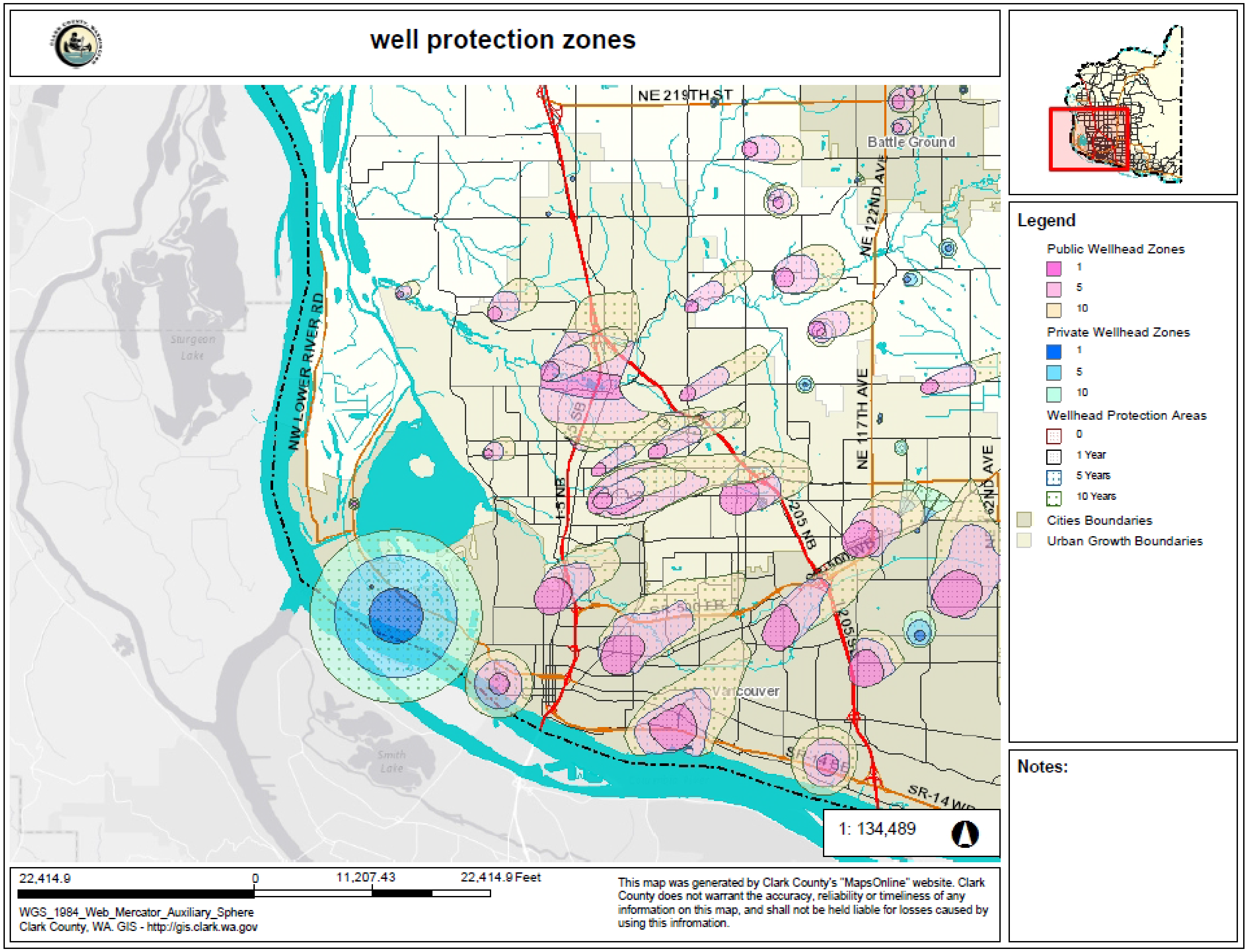

Figure 3.3-8. Troutdale Aquifer System—Wellhead Protection Zones

Source: Clark County 2015.

Note: The wellhead protection areas show 1-, 5-, and 10-year zones. Each zone represents the length of time it would take a particle of water to travel from the zone boundary to the well. An enlarged version of this figure is available in Appendix P.11.

Groundwater Use

Groundwater has a variety of beneficial uses in the vicinity of the proposed Facility, including domestic/municipal, agricultural, and industrial uses. The site and surrounding areas are within the EPA-designated sole source TAS covering much of Clark County (see Figure 3.3-7) (EPA 2006).

The City is entirely dependent upon groundwater from the TAS for drinking water supply. The water supply wells are dominantly within the highly productive “catastrophic flood deposit” portion of the USA, rather than in the TGA or the lower confined aquifer units. The City pumps water from seven wellfields, with 43 wells extending into the Orchards, Troutdale, and Sandy River Mudstone aquifers of the TAS. The closest wellfield is located upgradient, approximately 2 miles northeast of the proposed Facility, and produces from the USA.

CPU operates a gas-fired power plant (Lower River Road Generating Plant) adjacent to the proposed Facility. Two high-yield wells pump groundwater from a depth of approximately 150 feet bgs for use in the cooling system at the plant. It is believed that that these wells influence groundwater flow direction, drawing water from the southwest and Columbia River.

A number of wells between 54 to 128 feet deep operate on the Port property for both potable and nonpotable uses (Table 3.3-4).

Table 3.3-4. Wells on Port Property

Name	Depth (feet)	Pumping Rate (gpm)	Water Use
Port Well 1	80	1,500	Drinking Water
Port Well 2	78	1,200	Drinking Water
Port Well 3	80	1,500	Drinking Water
Fabricated Products	54	2.5 (Average)	Cooling Water
Port Groundwater Treatment System	120	2,500	Remediation
Parcel 2	Unknown	80	Irrigation
Great Western Malting – PW-4	123	2,500	Cooling water
Great Western Malting – PW-5	128	2,500	Cooling water
Terminal 5	116	600 to 1,500	Nonpotable

Source: Graves, pers. comm., 2013 a, b, c
gpm = gallons per minute

A number of high-producing wells, installed between 1940 and 1967 and associated with the former Alcoa facility, are listed in Ecology’s well-log database (Ecology 2013a). Well abandonment forms were located for some, but not all, of these wells; no information is available on the current status of remaining wells but it is assumed that they were abandoned during site remediation. Copies of all well abandonment forms should be obtained before construction is allowed at the site (included as a mitigation measure listed in Section 3.3.5).

Historical Operations and Onsite Groundwater Quality

In some areas of the proposed Facility site, groundwater quality has been affected by historical industrial operations dating back to the 1940s. Alcoa constructed an aluminum smelter on the western portion of the site in 1940. Between 1944 and 1970, a number of fabrication operations were added to form aluminum into finished goods, such as wire, rod, and extrusions. Alcoa operated the smelter facility from 1940 to

1987 when it was sold to VANALCO (subsequently acquired by Evergreen). Alcoa retained the extrusion mill and other portions of the property. All smelting, fabrication, and other operations ceased in 2000. The various historical industrial operations contributed to soil and groundwater contamination through leaking underground storage tanks, onsite waste disposal, leaking transformers, unlined sludge ponds, scrap metal recycling, smelting operations, and other fabrication processes. In addition, over the years, several areas of the property were filled with a variety of waste materials generated at the site including furnace brick, scrap aluminum, alumina, steel wire, and miscellaneous solid and industrial waste.

Cleanup work at the site was started in 1986 with the voluntary removal of hydraulic oil and PCB-contaminated soil. The site was listed on the National Priorities List (a list of sites eligible for long-term remedial action financed under the federal Superfund program) in 1990 (EPA 2013a). Several administrative orders and Consent Decrees have been issued for the site throughout the remediation process to address contamination identified at various portions of the site (see Section 3.8.2.1). The primary contaminants of concern included VOCs, PAHs, PCBs, cyanide, fluoride, and petroleum hydrocarbons.

A number of remedial activities have been conducted on the former Alcoa/Evergreen property over the years, including the following:

- Underground storage tanks were decontaminated and abandoned in place or removed. Soil and groundwater in the area of tanks was sampled during the decommissioning process to determine if additional remedial activities were required.
- Transformer/rectifier yards were investigated to determine if PCBs had been released into the soil. Contaminated soil was removed and disposed in accordance with state and federal regulations.
- Stormwater at the Alcoa/Evergreen property was captured in two stormwater lagoons. Solids in the lagoons were periodically pumped to unlined sludge ponds. During the closure of the ponds, investigations were conducted on the impact of the lagoons and ponds on soil and groundwater; the material was tested and determined not to be a dangerous waste.
- Excavation of contaminated soil and sediment and consolidation of material under engineered caps was undertaken (Figure 3.3-9).

All the actions mentioned above have been completed, although contaminated groundwater is still present on portions of the property (see Figure 3.3-9). Contaminated groundwater has been detected in the vicinity of the East Landfill (trichloroethylene [TCE] and vinyl chloride, PCBs, PAHs, and fluoride); former North and North 2 Landfill (PCBs and PAHs); and shoreline area (PCBs and PAHs) at concentrations above state- and federally designated human health-based risk levels. As identified in the Final Supplemental Cleanup Action Plan issued in 2011 (Ecology 2011), remaining activities are focused on remediating the TCE and vinyl chloride (a breakdown product of TCE) found in groundwater at the East Landfill (Figure 3.3-9) at concentrations above maximum contaminant levels. The actions identified in the plan are to continue to monitor conditions and to allow the remaining contaminants to attenuate naturally. Additional information on site cleanup activities can be found in Section 3.8 of this Draft EIS and on the EPA website (EPA 2013a) or the Ecology website (Ecology 2013b).

Historical Operations and Nearby Groundwater Quality

A number of properties located in the general vicinity of the proposed Facility have been documented as sources of contamination to groundwater by either the EPA or Ecology. Information on sites with known and potential contamination located near the proposed Facility site was obtained from federal and state environmental databases (Ecology 2013b, EPA 2013b). A search of EPA's Comprehensive

Environmental Response, Compensation, and Liability Information System (CERCLIS) database identified one former Superfund site within the footprint of the proposed Facility: the former Alcoa smelter site. In addition, Ecology representatives provided information on several hazardous waste cleanup sites within 1 mile of the proposed Facility, which are in various stages of remediation (Table 3.3-5).

Other active remediation sites involving hazardous materials located within the proposed Facility site are listed in Table 3.3-5. These sites are all located east of the location of the proposed Facility and at a side gradient to groundwater flow in the area. According to available information, it is anticipated that remediation work (being conducted by others) at the identified sites would be in progress, completed, or require no further action at the time of startup of the proposed Facility. Additional information about the site and site remediation activities is on the Ecology Toxics Cleanup website (Ecology 2013b).

Floodplains

Upstream river flows are controlled by a system of dams throughout the Columbia River Basin, including 14 dams on the mainstem, including Bonneville Dam, approximately 50 miles upstream of the proposed Facility. Regional tributaries to the Columbia River downstream of the mainstem dams, including the Willamette River, influence flood hydrographs near the proposed Facility. The Columbia River has a long history of flooding, with the flood stage near the Port at 16 feet, which was recently exceeded (17.26 feet NGVD) on June 1, 2011.[4] Additional sources indicate that the historical flood of record (in the post-dam era) occurred on February 9, 1996 (Halpert and Bell nd) with a maximum water elevation of 27.20 feet (Clark County nd).

The most recent Flood Insurance Rate Maps (FIRMs) released by the Federal Emergency Management Agency (FEMA) indicate that most of the proposed Facility site is located outside the 100-year floodplain, with the exception of the marine terminal (Area 400). The FIRMs are dated September 2012, and do not reflect recent construction activity on Parcel 1A (storage area [Area 300]) where filling has been completed onsite since the FIRMs were published. The proposed Facility site ground surface ranges in elevation from 30± feet NAVD 88 at the top of the river bank to 39± feet NAVD 88 near Old Alcoa Access Road. The FEMA 100-year floodplain elevation at this location is 30 feet NAVD 88. The proposed Facility site boundary extends into the Columbia River and, therefore, portions of the site are within the 100-year floodway of the main channel (Figure 3.3-10). The 500-year floodplain identified by FEMA includes the entire site, with a 1-foot inundation zone and up to 3-foot-deep localized ponding (FEMA 2015).

4 NGVD 29 was superseded by NAVD 88 for most USGS survey data.

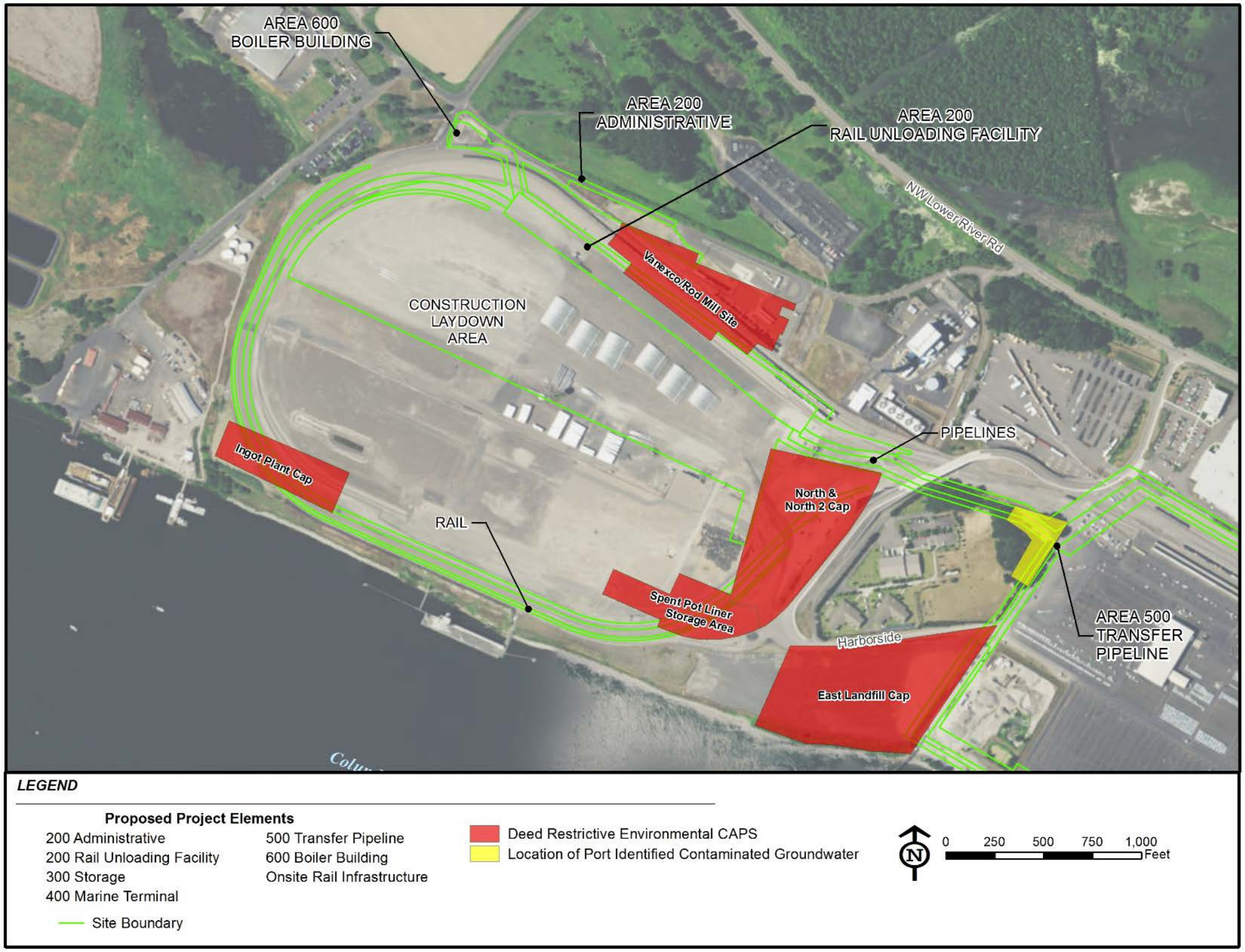

Figure 3.3-9. Contaminated Site Areas

Source: BergerABAM 2015c

An enlarged version of this figure is available in Appendix P.11..

Table 3.3-5. Hazardous Materials Remediation Sites in Project Vicinity

Site	Location	Distance from Project*	Description	Media	Primary Contaminant(s)	Cleanup Status
BNSF Railway Vancouver Cleanup Site	1515 W 39th St. Vancouver, WA 98660	1.6 miles	Railroad switching yard	Soil groundwater	Halogenated organics; metals; petroleum products	Awaiting cleanup; Agreed Order to be in place early in 2014
NuStar Energy LP	2565 NW Harborside Dr. Vancouver, WA 98660	1 mile	Ship terminal since the late 1960s; receives, stores, and transfers bulk chemicals, jet fuel, and methanol	Soil groundwater Sediment	Chlorinated solvents	Cleanup started
Swan-Cadet Manufacturing (Port of Vancouver Building 2220)	2001 and 2500 W Fourth Plain Blvd. Vancouver, WA 98660	1.25 miles	Former and current electric heating equipment manufacturer	Soil groundwater Air	Chlorinated solvents	Cleanup started
Chevron Bulk Plant 61001854	1801 W 39th St. Vancouver, WA 98660	1.6 miles	Bulk fuel terminal (1912–1983) with 10 aboveground storage tanks	Soil groundwater	Petroleum products	Cleanup started
Fort Vancouver Plywood	3103 NW Lower River Rd Vancouver, WA 98660	0.9 mile	Former manufacturing facility	Soil groundwater	Chlorinated solvents	Monitoring ongoing
Carborundum Facility	3103 NW Lower River Rd. Vancouver, WA 98660	0.9 mile	Former silicon carbide manufacturing facility	Soil groundwater Surface water	PAHs, carcinogenic PAHs	No further action (1998)
Brazier Facility	1401 Industrial Way Vancouver, WA 98660	2 miles	Wood preserving and millwork facility	Soil groundwater	Petroleum products	Monitoring ongoing
Automotive Services, Inc.	2327 W Mill Plain Blvd. Vancouver, WA 98660	1.4 miles	Former car wash site	Soil groundwater	Petroleum products	Monitoring ongoing

Sources: Schmall, pers. comm., 2013; Ecology 2013a

Note:

* Distances measured from center of the Project area

BNSF = Burlington Northern Santa Fe, PAHs = polycyclic aromatic hydrocarbons

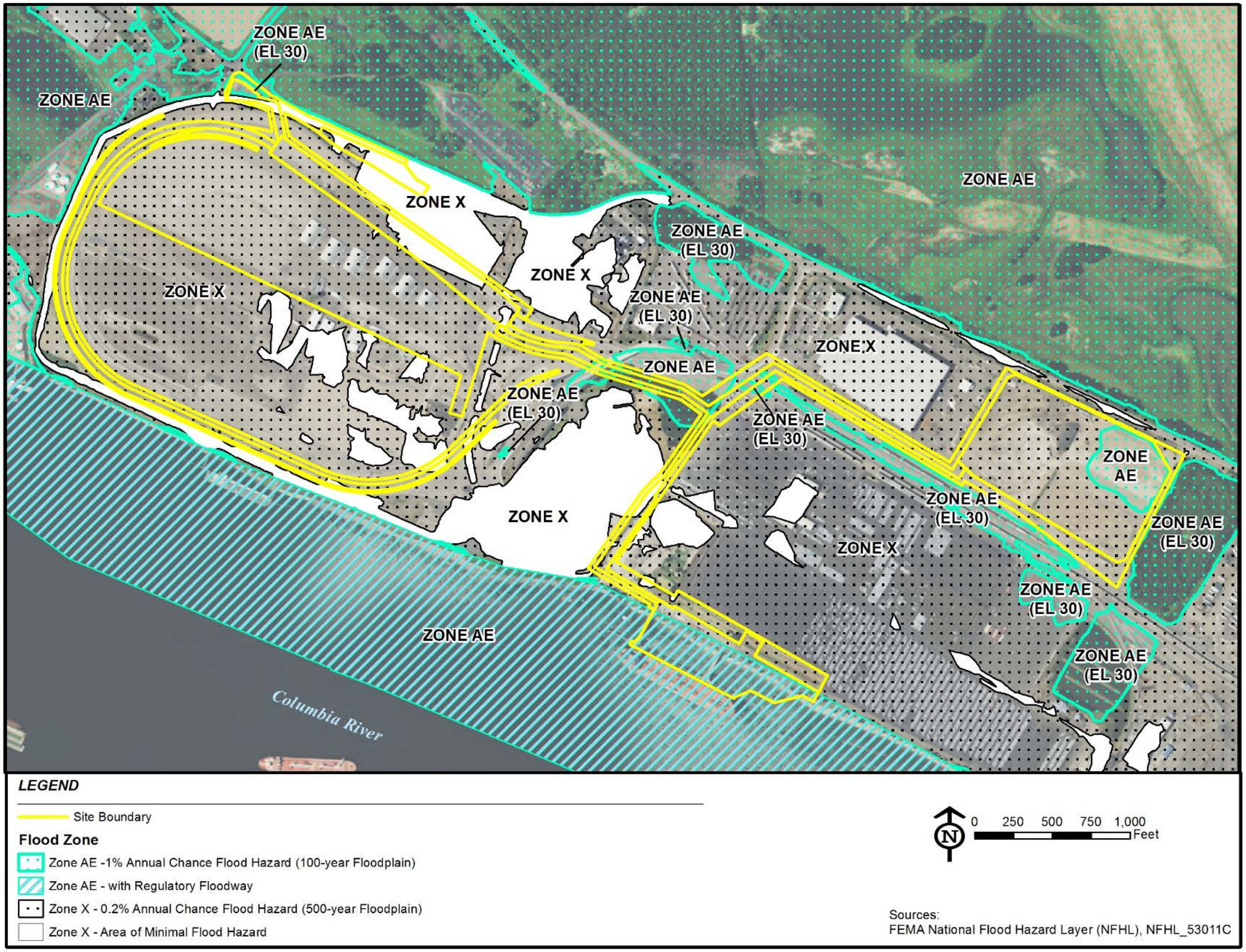

Figure 3.3-10. Floodplains at Proposed Facility Site

Wetlands

The National Wetlands Inventory (NWI) covering the Vancouver, Washington, USGS quadrangle (USFWS 1989) indicates the types, locations, and area of wetlands within the Project site and immediate vicinity at the time of the NWI (Figure 3.3-11). Previously, tidally influenced riverine and palustrine (freshwater) wetlands were present within the immediate vicinity. However, many of the wetlands have since been filled through permitted development activities at the Port. Most recently, the Port filled an approximate 1.8-acre isolated emergent wetland in 2012 located in the northeastern corner of Parcel 1A. The NWI also identified two isolated wetlands located north of the JWC. The boundaries of these wetlands were delineated in 2006 and 2007 in association with the Port's West Vancouver Freight Access (WVFA) project (JD White Company 2009). These wetlands were filled as part of that project in 2007. Impacts were permitted under a USACE Nationwide Permit (NWP-2007-721) and an Ecology administrative order (Administrative Order 6902), and mitigation was accomplished through the purchase of credits in the Columbia River Wetland Mitigation Bank (CRWMB).

The wetlands assessment completed in 2013 (BergerABAM 2013) found no wetlands in areas of the proposed Facility but three wetlands are present within 300 feet of the proposed Facility site. These include a wetland mitigation site located immediately east of the proposed storage tank area (Parcel 1A mitigation site), the CRWMB located north of SR 501, and a wetland mitigation site west of the proposed Facility site (Parcel 2 Mitigation Site) (Figure 3.3-12). All three of these wetlands are separated from the proposed Facility site by rail lines and/or roads.

The Parcel 1A wetland mitigation site was established in 1994 under USACE permit number 94-00061. This approximately 7.9-acre wetland is a depressional, palustrine forested wetland, vegetated with mature black cottonwood trees and a variety of native shrubs and herbaceous species. The Parcel 2 wetland mitigation site is an approximately 16.4-acre mitigation site, situated on a 31.3-acre parcel north of the existing Terminal 5 site and separated from the site by the east/west-oriented private Port access road. The mitigation site was established in 2000, under USACE permit number 96-1850, for wetland impacts associated with the initial development of the storage area (Area 300). The mitigation site received final approval from USACE in 2007. The site is currently a mosaic of forested, scrub-shrub, and emergent vegetation.

The most significant complex of wetlands in the area near the Port is at the southern end of Vancouver Lake. This wetland complex comprises a mosaic of emergent, scrub-shrub, and forested wetlands that are hydrologically connected to Vancouver Lake and, by extension, the Columbia River. These wetlands provide high-quality, seasonally inundated, tidally influenced, and permanently flooded habitats that most closely resemble the original hydrologic and wetland habitat functions of the Vancouver Lake Lowlands. An approximately 154-acre portion of this wetland complex, located on Port Parcel 6, has been established as the CRWMB. The CRWMB and the Vancouver Lake Lowlands are separated from the proposed Facility site by SR 501 (NW Lower River Road).

A series of shallow, linear, stormwater swales are located in the southwestern corner of Terminal 4. These features were excavated from uplands for the purpose of stormwater treatment. All other portions of the Project site above the OHWM are either impervious, paved, or gravel-covered surfaces, or are upland ruderal grass/forb habitats that are clearly dominated by upland vegetation and have neither the potential to accumulate nor detain surface water.

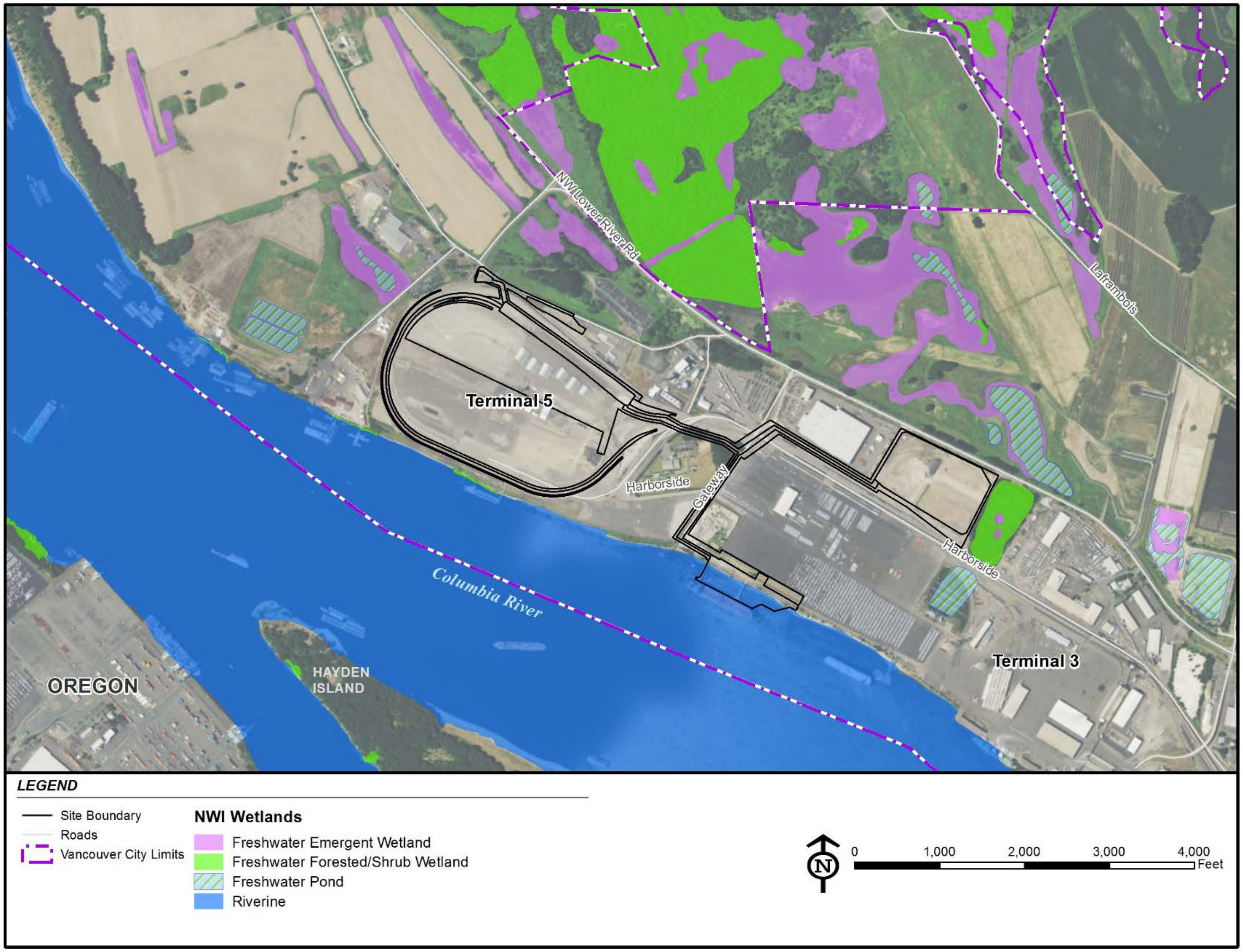

Figure 3.3-11. NWI Coverage of the Facility Site

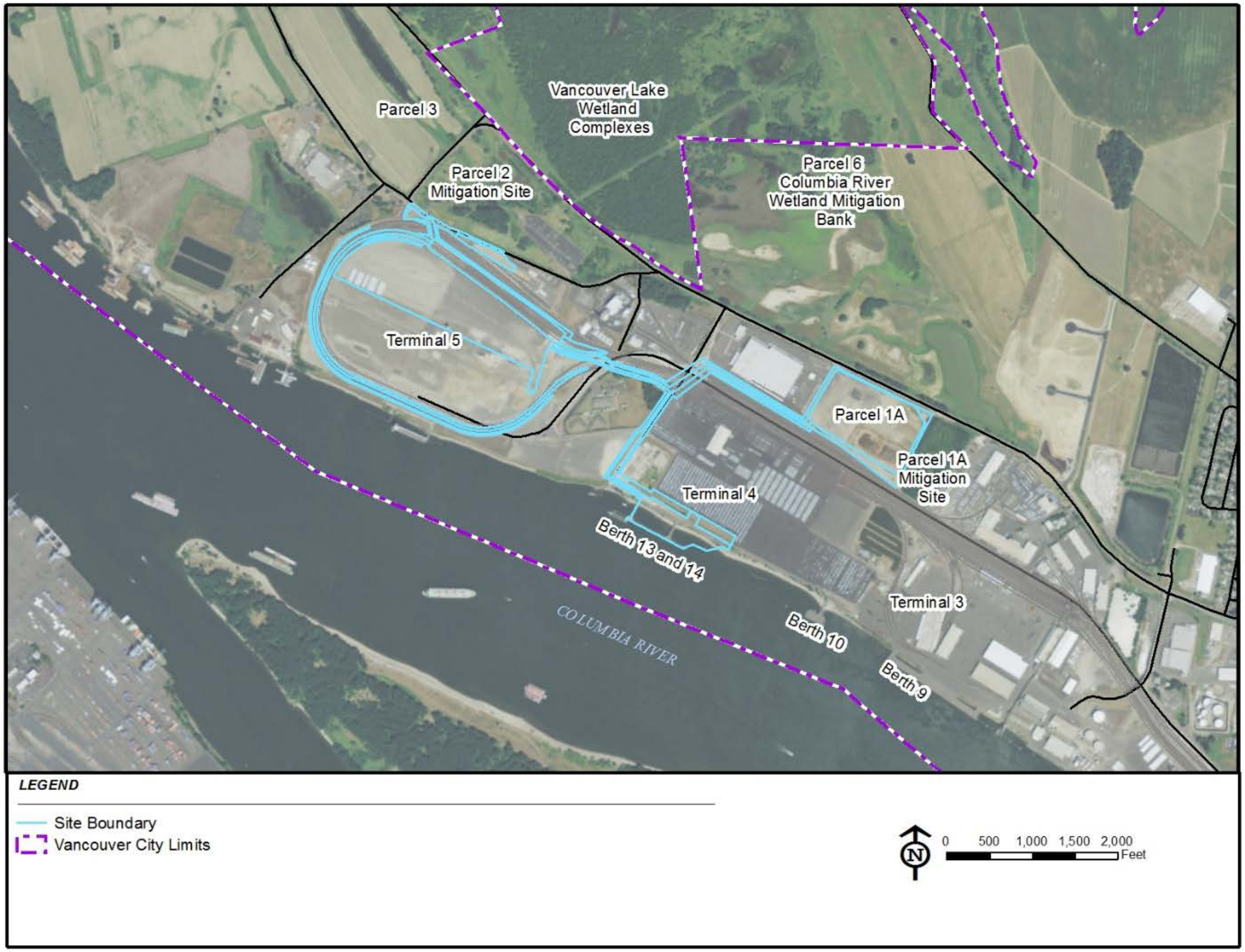

Figure 3.3-12. Named Wetlands in the Facility Vicinity as of 2013

3.3.2.2 Rail Corridor

Surface Water

Key surface water resources along the rail corridor in Washington include numerous freshwater rivers and small tributaries to the Columbia River, as well as the Columbia River mainstem (see Appendix P.3). This section highlights the linear water features by number and length, with additional information about the size and type of surface waterbodies included below under the wetlands subsection.

The rail corridor parallels and crosses segments of the Spokane River (NWAC 2011). Within the Middle Spokane River (WRIA 57), the river and the Spokane Valley-Rathdrum Prairie aquifer (discussed in further detail below) are intimately linked. Upstream of Spokane Falls in downtown Spokane, the river is relatively low gradient and within a broad valley, but downstream, the river is deeply entrenched in a bedrock canyon. Spokane River seasonal regimes and peak flows are modified by seven hydroelectric dams, including the City of Spokane's Upriver Dam in eastern Spokane and Avista Utilities' Upper Falls and Monroe Street dams in downtown. Rail lines cross over the Spokane River at two locations upstream of the Upriver Dam and at several additional sites around the urban area, and run immediately adjacent to the river for considerable distances (NWAC 2011). Rail lines also cross Marshall Creek in several locations and run parallel, immediately adjacent to the creek, in many locations, particularly along South Cheney Spokane Road.

The rail corridor runs parallel to and within 1 mile of the Columbia River (in many areas, directly adjacent) for approximately 216 miles between Kennewick/Pasco, Washington, and the proposed Facility. This subsection of the rail corridor is identified as the rail-Columbia River study area for analysis (Figure 3.0-2), and is of particular importance for the spill impact discussions in Chapter 4.

Four major dams and locks on the Columbia River are within the rail corridor (along the mid-Columbia River study reach): Bonneville (completed 1938), McNary (completed 1957), The Dalles (completed 1960), and John Day (completed 1971). These dams, as well as other upstream dams on tributaries and the main channel, flood control levees, and other water conveyance systems and watershed uses, have altered the river's hydrology and flow regime, while providing hydroelectric power, irrigation, and flood control and allowing the river to function as a commercial transportation route. The river between the dams is essentially made up of reservoir pools with deeply submerged riverbed features and shorelines ranging from bedrock headlands and wave-cut platforms to sand, gravel, and cobble beaches and marshes (NWAC 2015). Water quality in the Columbia River is generally good; however, known exceedances of permit limits on dam operations for temperature and total dissolved gases have occurred in the reservoirs created by the dams (Ecology 2015).

A total of 355 linear miles of surface water features occur within the rail corridor and 114 linear miles of surface water features occur within the rail-Columbia River corridor (Table 3.3-6). Surface water features include intermittent and perennial streams, canals and ditches, artificial paths (reservoir impoundment of the Columbia River), and water connector/pipelines (Table 3.3-6).

A total of 549 designated WDNR stream segments occur within and adjacent to the 1-mile-wide rail corridor, primarily unknown or not classified and nonfish-bearing streams, but also 75 fish-bearing and 44 shoreline types (Table 3.3-7). These are discussed further in Section 3.6.

Outside of Washington, the rail corridor that would be used to transport crude oil from Williston, North Dakota, to the proposed Facility traverses two major watersheds: the Missouri River watershed in eastern Montana and North Dakota and the Columbia River in northern Idaho and western Montana. The Missouri River, the longest river in North America, has its headwaters in the Rocky Mountains of western Montana. The river flows easterly through Montana and then southeasterly through western North

Dakota, ultimately emptying into the Mississippi River north of St. Louis, Missouri. Major rivers within this portion of the rail corridor include the Marias and Milk rivers, which enter the Missouri from the north, and the Yellowstone River and its tributaries including the Bighorn, Tongue, and Powder rivers. The Little Missouri River is another major tributary, which drains into Lake Sakakawea near the eastern end of the rail corridor.

Table 3.3-6. Surface Water Features in the Rail Corridor and Rail-Columbia River Corridor Study Areas in Washington

Surface Water Feature	Linear Miles within the Rail Corridor	Linear Miles in the Rail-Columbia River Corridor
Perennial Stream/River	54	22
Intermittent Stream/River	258	25
Artificial Path	17	65
Canal/Ditch	21	1
Connector/Pipeline	4	2
Total	355	114

Source: National Hydrography Dataset (USGS 2014)

Table 3.3-7. Washington Stream Types in the Rail Corridor Study Area

Stream Type	Number
Type F (fish bearing)	75
Type S (shoreline)	44
Type N (nonfish bearing)	132
Type U (not classified)	298
Total	549

Source: WDNR 2006

Groundwater

The following summary of groundwater resources along the main rail corridor is based on information taken from the USGS Groundwater Atlas of the United States, Idaho, Oregon, Washington (USGS 1994).

Two types of aquifers are common along the main rail corridor. The most prolific and widespread aquifers in the area are those in unconsolidated deposits that consist primarily of alluvial sand and gravel that fill basins. These aquifers are important sources of water for public supply and domestic, commercial, agricultural, and industrial needs because of their location in generally flat lowlands where human activities are concentrated. Permeability of the unconsolidated deposits is variable; sand and gravel commonly yield from 20 to 2,000 gpm to wells. Coarser deposits along major streams and deposits of glacial outwash yield from 500 to 2,500 gpm. Public supply wells completed in glacial outwash in Washington reportedly yield as much as 10,000 gpm in the Puget Sound area and 19,000 gpm in Spokane Valley. The ability of this type of aquifer to yield water usually decreases with depth as the unconsolidated deposits become progressively finer grained and compacted.

The other important aquifers are within underlying volcanic rocks, usually Miocene basaltic rocks of the Columbia Plateau in northeastern Oregon and southeastern Washington. Water from these aquifers is used primarily for irrigation. Permeability of the Miocene basaltic-rock aquifers is extremely variable and yields range from 1 to several thousand gpm. The largest yields are obtained from wells that penetrate numerous permeable zones. Along the main rail corridor, the Columbia Plateau regional aquifer system occupies about 50,600 square miles extending across a small part of northern Idaho, northeastern Oregon, and a large part of southeastern Washington.

Geologic structures are important controls on groundwater occurrence and movement in the Columbia Plateau. Folded and subsequently eroded layers of rock crop out in upland areas where water enters the aquifer system; the water then moves down the gradient along permeable zones. In places, tight folds or faults, or both, and gently dipping layers of rock sloping opposite the direction of groundwater movement can impede the movement of groundwater. The general movement of water in the aquifer system is from recharge areas near the edges of the plateau toward regional drains and the Columbia River. Individual basalt flows in the Columbia River Basalt Group range from a few tens of feet to about 300 feet in thickness and average about 100 feet. Some thick flows that are exposed in canyons and road cuts display extensive fracture patterns owing to differential rates of cooling. The tops and the bottoms of flows typically are permeable because of rubble zones, vesicles, and fractures. Some of these open spaces, however, are filled with clay minerals that decrease permeability. The central parts of most flows are dense and almost impermeable. Openings that have been caused by minor vertical cooling fractures might provide some permeability in the central part of the flows. Geologic structures affecting water recharge and movement also determine the vulnerability to oil spill movement into the aquifer, along with other factors like product types and response timing. These potential impacts are further discussed in Chapter 4.

The following EPA-designated sole source aquifers are crossed by the rail corridor (see Appendix P.4):

- **Spokane Valley-Rathdrum Prairie Aquifer.** This aquifer underlies about 370 square miles of a relatively flat, alluvium-covered valley surrounded by bedrock highlands, extending to a depth of approximately 1,400 feet bgs. This aquifer, which provides drinking water for approximately 400,000 residents, extends from the southern end of Lake Pend Oreille in northern Idaho through Spokane Valley in Washington. The aquifer is largely composed of unconfined sand and gravel from Quaternary flood deposits. Sources of recharge to the aquifer include infiltration from precipitation, return flow from water applied at land surface, leakage from the Spokane and Little Spokane rivers and adjacent lakes, and surface and groundwater inflow from tributary basins (USGS 2005a, b; IDEQ 2009). No identified barrier (aquitard) controls the vertical migration of groundwater, making the aquifer susceptible to contamination. The proposed main rail corridor would cross 21.7 miles of the aquifer. The rail corridor would also cross approximately 11.2 miles of the source recharge area.
- **Troutdale Aquifer System.** This aquifer system serves groundwater users in Clark County, Washington. This aquifer is discussed in more detail in Section 3.3.2.1 above. The main rail corridor would cross 17.2 miles of the TAS.

Outside of Washington, the rail routes that would be used by unit trains supplying crude oil to the proposed Facility would cross numerous groundwater basins in Idaho, Montana, and North Dakota. The extent, type, and vulnerability of groundwater resources varies widely in the areas crossed by the rail route.

Water Supply

Surface water along the rail corridor in Washington is used for a wide range of purposes, including drinking water; industrial process water; irrigation; groundwater recharge; and providing for hydropower generation and recreational activities.

Surface Water Diversions

Surface water is collected through dams, diversions, or pump systems from many waterbodies along the rail corridor (see Appendix P.4). A total of 321 points of diversion are located within the 1-mile-wide rail corridor in Washington, and 25 occur in the mid-Columbia River corridor in Washington (Table 3.3-8). The overwhelming majority of these surface water diversions in Washington are for domestic and municipal uses (drinking water as the key component of the use), but they are also for agricultural, commercial/industrial, environmental, and recreational uses (Table 3.3-8).

On the Oregon side of the Columbia River, approximately 442 points of diversion occur within the rail-Columbia River corridor (Table 3.3-8). The use categories represented on the Oregon side of the Columbia River are diverse, with substantial numbers of agricultural, environmental, industrial, and recreational diversions, in addition to domestic and municipal uses.

The City of Hermiston public water system draws municipal supplies water along the Oregon side of the Columbia River within the rail-Columbia River corridor.[5] A total of 8,442 acres of the Hermiston surface water Drinking Water Source Area designated by the State of Oregon is in the corridor.

Table 3.3-8. Surface Water Diversions in the Rail and Rail-Columbia River Corridor Study Areas in Washington and Oregon

Principal Use Category*	Rail Corridor in Washington	Rail-Columbia River Corridor in Washington	Rail-Columbia River Corridor in Oregon
Domestic and Municipal	199	1	101
Agricultural	98	17	197
Commercial/Industrial	11	6	49
Environmental	6	1	80
Recreation, Other, or Unknown	7	0	13
Total	321	25	442

Sources: Oregon Water Resource Department 2014, Ecology nd.

Note:

* The water use category terminology differs in the Washington and Oregon databases; they are grouped herein to include similar principal uses.

Outside of Washington, the rail route would be adjacent to and/or cross surface waterbodies near water supply diversions for a range of private and public uses throughout the rail corridor in Idaho, Montana, and North Dakota. The diversion magnitudes, service areas, and number of connections/users vary widely along the rail route.

Groundwater Wells and Wellhead Protection Zones

Public and private groundwater pumping for drinking water, irrigation, and various commercial and industrial uses occurs along the rail corridor (see Appendix P.4). Approximately 21,229 acres of identified public groundwater supply protection zones occur in and adjacent to the rail corridor study area

5 The specific locations of public water inlets are not disclosed for public security reasons.

in Washington (Table 3.3-9). The rail corridor study area includes 13 wellhead protection areas (5-year time of travel) including potable water for several municipalities such as Spokane, Cheney, Sprague, Ritzville, Lind, Hatton, Connell, Mesa, Eltopia, and Pasco, as well as Eastern Washington University and the Finley School District.

The rail-Columbia River corridor study area includes 23 wellhead protection areas (5-year time of travel) covering approximately 52.5 acres in Washington that primarily serve cities and local communities; school districts; federal recreation areas; the Port; and, private commercial, industrial, and residential users.

In Oregon, the rail-Columbia River corridor includes 43 designated groundwater source protection areas spanning 11,237 acres and serving a broad mix of cities and local communities, federal and state recreation areas, and private commercial, industrial, and residential users.

Table 3.3-9. Acres of Public Groundwater Supply Protection Zones in the Rail Corridor and Rail-Columbia River Corridor Study Areas in Washington and Oregon

Principal Use Category[a]	Rail Corridor in Washington	Rail-Columbia River Corridor in Washington	Rail-Columbia River Corridor in Oregon
Community	18,048.7	17.4	-
Nontransient, Noncommunity	2,942.2	29.0	-
Transient Noncommunity	142.2	0.0	-
Group B Systems[b]	95.6	6.0	-
Cities/Communities	-	-	9,099
Private/Other	-	-	1,151
Park Facilities	-	-	808
Industrial/Commercial	-	-	179
Total	21,228.7	52.4	11,237

Sources: Oregon Spatial Data Library nd, Washington State Department of Health nd

Notes:

a Use category terminology differs for the Washington and Oregon databases; entries labeled with – are not relevant for each state.

b Group B public water systems serve fewer than 15 connections and fewer than 25 people per day.

The rail route would also cross unconfined aquifer recharge areas and/or wellheads for a variety of public and private uses throughout the rail corridor in Idaho, Montana, and North Dakota. The vulnerability of groundwater supplies to contamination, the size of recharge areas, and time of travel to wellheads vary widely along the rail route.

Floodplains

The vast majority of floodplains in the rail corridor study area occur along the Columbia River. Approximately 9,949 acres of designated FEMA 100-year floodplain are within the rail corridor between Spokane and Kennewick, primarily as small floodplains in separate watersheds, but including areas along the Spokane River, near the communities of Cheney, Tyler, and Sprague, and relatively narrow floodplains immediately adjacent to the railroad between Ritzville and Pasco.

Since the railroad bed is generally elevated above floodplains, the risk of flood hazard to the rail line is typically low, aside from crossing points where rail bridge abutments could be vulnerable to flooding, scour, or bank erosion. In rural areas with little historical or proposed urban development that could raise flood hazards to life and property, floodplain mapping by FEMA is incomplete. Therefore, additional areas of functional floodplains may be present but are not designated or regulated.

Outside of Washington, the rail route would cross numerous floodplains. Many of the areas in Idaho, Montana, and North Dakota along the rail corridor have unmapped or unregulated floodplains, in addition to FEMA-designated floodplains. For instance, only 1 percent of Montana's rivers and streams have established base flood elevations as of 2012 (Montana Department of Natural Resources and Conservation 2012). Impacts to rail transportation from flood hazards would be similar to those in Washington since the railroad bed is generally elevated above floodplains.

Wetlands

The rail corridor passes through and is adjacent to numerous wetland types, including riverine and lacustrine systems and a range of subsystems and classes, including those with limited vegetation and those with emergent, shrub-scrub, forested, and aquatic bed vegetation. Natural and modified hydrology and topography, and a range of inundation categories from permanent to temporary and/or artificial, are all represented. The NWI maps (see Appendix P.3) indicate the location and distribution of wetland types. River environments in the rail corridor include the Spokane River, Hangman Creek, small segments of other rivers and streams, and the tidally influenced portion of the Columbia River from Bonneville Dam to Vancouver. Lake environments along the rail corridor include impounded sections of the Spokane River (Upriver Dam Reservoir); Sprague Lake; Fish Lake; Queen Lucas Lake; and the mid-Columbia River. Freshwater ponds and wetlands along the rail corridor include a range of features and conditions. Discrete and connected networks of wetlands are prevalent along the rail corridor between Spokane and Pasco, primarily from Marshall to Sprague. The entire route between Kennewick and Vancouver has a dense mosaic of wetlands fringing or immediately adjacent to the large, contiguous deep water lake (impoundments) and river segments of the Columbia River and tributary mouths.

The rail corridor study area includes a total of 61,156 acres of NWI-delineated wetlands (Table 3.3-10), which represents about one-quarter (24.7 percent) of the 1-mile-wide rail corridor total area (see Appendix P.3).

Table 3.3-10. Wetland Types and Acreages within the Rail Corridor and Rail-Columbia River Corridor Study Areas

Wetland Type*	Code**	Description	Rail Corridor Study Area (acres)	Rail-Columbia River Corridor Study Area (acres)
Riverine, Tidal: Unconsolidated Bottom, Unconsolidated Shore, and Rocky Shore	R1UB and R1US, R1RS	Continuously flowing in natural or artificial channels, between estuarine and upper extent of tidal fluctuations; low gradient	7,370	21,368
Riverine, Lower Perennial: Unconsolidated Bottom, Unconsolidated Shore	R2UB and R2US	Continuously or periodically flowing in natural or artificial channels, connecting bodies of water low gradient; unconsolidated bed of sand and mud and less than 30 percent vegetation cover	11	2
Riverine, Upper Perennial: Unconsolidated Bottom, Unconsolidated Shore	R3UB And R3US	Continuously flowing in natural or artificial channels, high gradient, rock, cobble or gravel bed, and less than 30 percent vegetation cover	194	9
Riverine, Intermittent: Streambed	R4SB	Periodically flowing in natural or artificial channels, flowing only part of the year	8	12
Riverine (subtotal)			7,583	21,391

Table 3.3-10. Wetland Types and Acreages within the Rail Corridor and Rail-Columbia River Corridor Study Areas

Wetland Type*	Code**	Description	Rail Corridor Study Area (acres)	Rail-Columbia River Corridor Study Area (acres)
Lacustrine, Limnetic: Unconsolidated Bottom	L1UB	Deepwater lake, unconsolidated bed, less than 30 percent vegetation cover, permanently flooded, including diked and impounded	47,827	103,911
Lacustrine, Littoral: Aquatic Bed; Emergent; Rocky Shore; Unconsolidated Bottom; Unconsolidated Shore	L2AB; L2EM; L2RS; L2UB; L2US	Vegetated habitats on lake margins: shoreward bound to 6.6 feet below annual low water, erect, rooted, herbaceous plants, perennial, but not persistent	260	903
Lacustrine (subtotal)			48,087	104,814
Palustrine, Unconsolidated Bottom	PUB	Freshwater wetland/pond; at least 25 percent cover of particles smaller than stones and less than 30 percent vegetative cover	411	445
Palustrine, Unconsolidated Shore	PUS	Freshwater wetland/pond with less than 75 percent stones, boulders, or bedrock and less than 30 percent vegetative cover	10	17
Palustrine, Aquatic Bed	PAB	Freshwater pond; dominated by plants growing on or below the water surface	68	19
Palustrine, Emergent	PEM	Freshwater wetland/pond with erect, rooted, herbaceous plants, mostly perennial, including seasonally flooded	3,806	1,580
Palustrine, Scrub-Shrub	PSS	Freshwater wetland/pond dominated by woody species less than 20 feet tall	413	1,175
Palustrine, Forested	PFO	Freshwater wetland/pond dominated by woody tree species 20 feet tall or higher	780	1,088
Palustrine (subtotal)			5,488	4,324
Total			61,156	130,561

Source: Cowardin et al. 1979 (wetland types)

Notes:

* Riverine includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts of 0.5 ppt (parts per thousand) or greater.

Lacustrine includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with 30% or greater areal coverage; and (3) total area of at least 8 hectares (ha). Similar habitats less than 8 ha are also lacustrine if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin equals or exceeds 2.5 meters at low water. Lacustrine waters may be tidal or nontidal, but ocean-derived salinity is always less than 0.5 ppt.

Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergent, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation but with all of the following four characteristics: (1) area less than 8 ha; (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 meters at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.

** The wetland classification codes are a series of letter and number codes that have been developed to adapt the national wetland classification system to map form. These alpha-numeric codes correspond to the classification nomenclature that best describes the habitat.

R1UB = riverine tidal, unconsolidated bottom; R1US = riverine tidal, unconsolidated shore; R1RS = riverine tidal, rocky shore; R2UB = riverine lower perennial, unconsolidated bottom; R2US = riverine lower perennial, unconsolidated shore; R3UB = riverine upper perennial, unconsolidated bottom; R3US = riverine, upper perennial, unconsolidated shore; R4SB = riverine, intermittent, streambed; L1UB = lacustrine, limnetic, unconsolidated bottom; L2AB = lacustrine, littoral, aquatic bed; L2EM = lacustrine, littoral, emergent; L2RS = lacustrine, littoral, rocky shore; L2UB = lacustrine, littoral, unconsolidated bottom; L2US = lacustrine, littoral, unconsolidated shore; PUB = palustrine, unconsolidated bottom; PUS = palustrine, unconsolidated shore; PAB = palustrine, aquatic bed; PEM = palustrine, emergent; PSS = palustrine, scrub-shrub; PFO = palustrine, forested

Outside of Washington, the rail route would pass through wetland areas in Idaho, Montana, and North Dakota that contain various wetland types including some similar to those found within Washington.

3.3.2.3 Vessel Corridor

Surface Water

The Columbia River is a principal waterway for commerce and a primary water feature for human use and ecological functions in Washington. The following information focuses on the river's physical, hydrologic, hydraulic, water quality, and water supply aspects. Since the Columbia River forms the Oregon-Washington border, this section addresses both Washington and Oregon resources along the river.

The vessel corridor study area downstream of the proposed Facility includes the mainstem of the Lower Columbia River and the Columbia River Estuary. The Columbia River Estuary generally includes the area from the river mouth upstream to approximately RM 34, near the upstream extent of saltwater influence, as well as nearshore marine waters and the Columbia River plume (Lower Columbia Fish Recovery Board 2004). The Columbia River plume extends into the ocean beyond the mouth of the river as a lower salinity (relative to seawater) volume whose size and extent changes seasonally with streamflow, winds, and ocean currents, and is further described in Section 3.6. The mainstem portion refers to the section from RMs 34 to 146.1 (at Bonneville Dam), which forms the upstream barrier to tidal influence. Key tributaries entering the Columbia River along the vessel corridor (in downstream order) include the Lake, Lewis, Kalama, Cowlitz, Clatskanie, Elochoman, Grays, Deep, Youngs, Lewis & Clark, Chinook, and Wollacut rivers, along with other smaller creeks and streams (Appendix P.3). Table 3.3-11 identifies the number and length of water features within the vessel corridor in Washington.

Table 3.3-11. Surface Water Features in the Vessel Corridor Study Area in Washington

Water Feature	Linear Miles in the Vessel Corridor
Perennial Stream/River	104
Intermittent Stream/River	39
Artificial Path*	105
Canal/Ditch	20
Coastline	2
Total	312

Source: National Hydrography Dataset (USGS 2014)
Note:
* The Columbia River is Artificial Path in this reach

Simenstad et al. (2011) have recently proposed a multilevel ecosystem classification system for the Lower Columbia River and identified eight hydrogeomorphic reaches (Figure 3.3-13) that reflect a range of geologic and topographic controls, and fluvial and tidal processes, and possess distinct geomorphic and ecological components. The characteristics of each reach under existing conditions indicate that a range of hydrologic inputs, hydraulic forces and patterns, geomorphic features, erosion and sedimentation, floodplain connectivity, and water quality are present in the Columbia River along the marine corridor (Table 3.3-12). The greatest fluvial energy reaches are from RMs 37.9 to 64.0 and 64.0 to 73.9, since the downstream river valley expands and dampens flood effects. At the same time, tidal energy is relatively higher. The sediment within the river is generally sands, silts, and clays, with suspended sediment (finer sands and silts) typically delivered from the upstream regions of the Columbia River Basin. The Cascade Mountains are the source for bedload sands. The riverbed is formed by dynamic sand waves that move a few feet per day under low discharges but may travel nearly 200 feet per day during peak flows (Simenstad et al. 2011).

After years of study, the USACE performed the Columbia River Channel Improvement Project in 2006, which removed 2.6 million cubic yards of sand from targeted areas in the lower 103 miles of the river. The channel was deepened from RM 3 to 21 and from RM 95 to just beyond RM 104 to create a consistent 43-foot-deep shipping channel (USACE 2015a).

Table 3.3-12. Key Characteristics of the Columbia River Estuary Reaches

ID	River Miles (kilometers)	Reach Name	Key Characteristics
A	0–14.3 (0–23)	Coastal Lowlands, Entrance-Mixing	Extensive mixing of estuarine and ocean waters, especially by the Columbia River entrance, with broad mudflats and sandflats in peripheral bays. Very dynamic conditions with numerous disturbances: tides, storm surges, fluvial flooding, periodic earthquake effects including tsunami, and episodic volcanic sediment delivery.
B	14.3–37.9 (23–61)	Coastal Uplands, Salinity Gradient	Estuary converges to a confined river valley, but has broad, complex mosaic of channels, islands, and shoals. Combined effects of tectonic uplift and sediment accretion has produced shoaling and a succession of sandflats and mudflats to emergent marshes, scrub-shrub, and forested tidal wetlands on some islands (e.g., Russian Island).
C	37.9–64.0 (61–103)	Volcanics Current Reversal	Confined valley, but with large mid-channel islands, distributary channels and sloughs, and floodplains. Tidal influence decreases through this reach, and furthest upriver extent of tidal current reversals is within the reach. Natural disturbances include floods, high sediment inputs, and coastal subsidence from subduction zone earthquakes.
D	64.0–73.9 (103–119)	Western Cascades Tributary Confluences	Confined valley, but broad bottomlands at the confluences of the Cowlitz and Kalama rivers. Receives episodic sediment from upstream including large pulses of volcanogenic sediment from Mount St. Helens. Reach features undiked islands, dissected floodplains with numerous channels and actively migrating (accreting and eroding) margins, and a small tidal range (~0.5 foot) with rare current reversals.
E	73.9–85.1 (119–137)	Tidal Floodplain Basin Constriction	Reach is narrowly confined by bedrock and terraces, except for bottomlands at the confluences of the Lewis and Kalama rivers. High sediment inputs from Mount St. Helens. The floodplain islands and tributary deltas have thin caps of overbank flood deposits. Prominent channel migration, bar-and-swale on islands and floodplains (e.g., Deer Island). Tidal fluctuation is modest (~2.2 feet), but has a smaller influence during floods.
F	85.1–102.5 (137–165)	Middle Tidal Floodplain Basin	Widest floodplain reach of the upper estuary, with broad alluvial valley encompassing floodplain wetlands, ponds with bar-and-swale features, bedrock outcrops, islands, and distributary channels (e.g., Multnomah Channel). Dikes, levees, roads, and drainage features have highly altered the reach. Tributary sediment input has not matched the high rates of mainstem aggradation, which has drowned some of the tributary valley mouths. Particularly vulnerable to flooding, but little tidal influence, especially during high river flows.
G	102.5–126.8 (165–204)	Upper Tidal Floodplain Basin	Wide alluvial valley with broad floodplain upstream of the Willamette River confluence; modified by levees and fill. Sandy and Washougal rivers' confluences with narrow deltas and floodplain wetlands. Large sediment inputs from Mount Hood. Tidal range is low and generally less than river inputs or power peaking cycles from Bonneville Dam. The Port is located in this reach.
H	126.8–144.8 (204–233)	Western Gorge	Western end of the Columbia River Gorge, with bedrock boundaries, alluvial and colluvial fans, landslide complexes, and few floodplains and wetlands. Tidal influence is limited (~1 foot), and less than the influence of changing discharges from Bonneville Dam.

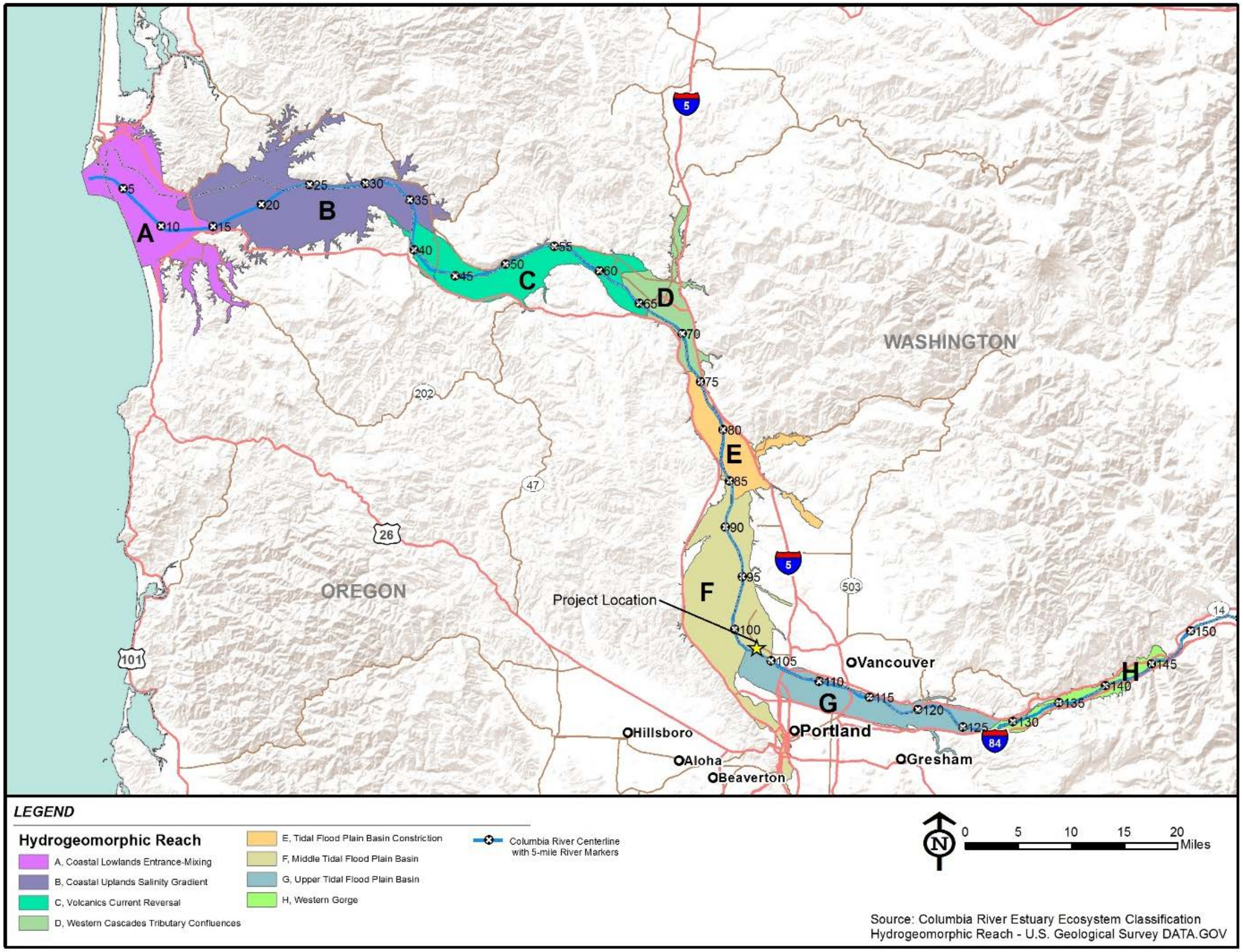

Figure 3.3-13. Hydrogeomorphic Reaches of the Columbia River Estuary Ecosystem

Source: Simenstad et al. 2011

Water quality in the Lower Columbia River may contain pollutants or be impaired for temperature or clarity. PAHs, PCBs, and PBDEs were found throughout the Lower Columbia River in water, sediment, and juvenile Chinook salmon (Lower Columbia River Estuary Partnership 2010). EPA's State of the River Report for Toxics (2009) further looks at these pollutants as well as mercury. EPA attempts to control the amount of toxics entering the river system through NPDES permitting and TMDLs for contributing systems, as well as through cleanup, remediation, and restoration programs. The study acknowledges that emerging pollutants of concern, such as pharmaceuticals, were possibly not evaluated. As also indicated by the discussion on sediment transport above, water clarity in the Lower Columbia Estuary is rated poor (EPA 2007). Sediment transport, causing clarity issues, and contaminants can come from agricultural, municipal, and industrial dischargers. For instance, PCBs and PBDEs, which are breakdown products of DDT, are thought to come primarily from agricultural land. PAHs on the other hand would come from petroleum products and from cars, roads, other nonpoint sources, and industry. PAH concentrations exceeded the human health criteria less frequently than PCBs in one study (Johnson and Norton 2005). Density differences between the fresh river water flowing downstream and the saline water driven upstream on daily tides can form a tidal wedge that increases turbidity naturally (NWAC 2003).

The vessel corridor outside of Washington includes open waters of the Pacific Ocean and other waters at end destinations. They include San Francisco Bay and associated waterbodies, San Pedro Bay (Los Angeles Area), Puget Sound, Hawaii, Gulf of Alaska, and Cook Inlet.

Groundwater

Groundwater underlies the Columbia River and net groundwater flow is generally from contributing aquifers toward the Columbia River, although seasonal fluctuations in river elevation and near-river groundwater pumping can create local variations in groundwater flow direction. No developed groundwater resources are in the out-of-state vessel corridor, although vessel corridors at destination ports may include groundwater resources.

Water Supply

Surface Water Diversions

Numerous public and private surface water diversions are within the vessel corridor (see Appendix P.4). In Washington, there are 12 points of diversion within the vessel corridor study area, the majority of which are for agricultural uses, with a few for domestic and municipal uses (drinking water is the key component of the use), and recreation (Table 3.3-13). On the Oregon side of the Columbia River there are 79 surface water diversion points, with substantial numbers of agricultural, environmental, industrial, and recreational diversions, in addition to the dominant domestic and municipal uses (Table 3.3-13).

The State of Washington drinking water system database identifies the Columbia River as one city's emergency water source. In addition, a number of industrial users of water along the river include Weyerhaeuser and Kapstone in the Longview area.

The State of Oregon has identified three public drinking water system intakes along the Columbia River extending from Vancouver downstream to Astoria (i.e., Georgia-Pacific CPLP Wauna, Portland General Electric Beaver Generating Station, and the Rainier Water Department) (Appendix P.4). A total of 28,931 acres of the Oregon-designated surface water Drinking Water Source Areas are within the vessel corridor (approximately evenly shared by the three public systems).

Table 3.3-13. Points of Surface Water Diversions in the Vessel Corridor Study Area

Principal Use Category*	Points of Diversion in Washington	Points of Diversion in Oregon
Domestic and Municipal	3	39
Agricultural	7	15
Commercial/Industrial	0	20
Environmental	0	4
Recreation, Other, or Unknown	2	1
Total	12	79

Sources: Oregon Water Resource Department 2014, Ecology nd

Note:

*The water use category terminology differs in the Washington and Oregon databases; they are grouped herein to include similar principal uses.

Groundwater Sources and Wells

Public and private groundwater pumping for drinking water, irrigation, and various commercial and industrial uses occurs along the vessel corridor (see Appendix P.4). A total of 942 acres of identified public groundwater supply protection zones occur in and adjacent to the rail transportation corridor, as summarized in Table 3.3-14.

State-designated public drinking water supply groundwater protection zones along the vessel corridor in Washington include seven wellhead protection areas (5-year time of travel) covering 42 acres that serve:

- Port of Vancouver (three wells)
- Ridgefield Public Works
- City of Woodland
- Walt’s Meats
- City of Kelso

State-designated public drinking water supply groundwater protection zones along the vessel corridor in Oregon include: 10 wellhead protection areas (5-year time of travel) covering 902 acres that serve:

- Reeder Beach Resort
- Columbia City Municipal Waterworks
- City of St. Helens
- Portland General Electric Trojan Nuclear Plant
- City of Prescott
- Riverwood Mobile Home Park
- Rivers Edge Mobile Park
- Disstop Inn
- Island Community LLC
- OPRD Bradley State Wayside

Table 3.3-14. Public Groundwater Supply Protection Zones in the Vessel Corridor Study Area

Principal Use Category*	Vessel Corridor in Washington	Vessel Corridor in Oregon	Total
Community	42.2	-	42.2
Cities/Communities	-	346	346
Private/Other	-	489	489
Park Facilities	-	6	6
Industrial/Commercial	-	61	61
Total	42.2	902	944.2

Sources: Oregon Spatial Data Library nd, Washington Department of Health nd

Note:

* Use category terminology differs for the Washington and Oregon databases; entries labeled with – are not relevant for each state.

The ocean and near-coastal waters are not used as developed water supply. Areas within vessel corridors at destination ports may include surface water intakes and/or groundwater wellheads for a variety of beneficial uses.

Floodplains

As is common for the lower reaches of large rivers, the 100-year flood elevation decreases along the Lower Columbia River from 30 feet (NAVD 88) at the Port to just 8 feet near the river mouth. The vessel corridor in the navigation channel, is by definition, within the primary flood conveyance area of the main channel (i.e., the floodway) and surrounded by additional floodway and floodplain as controlled by natural topography and levees. FEMA-designated floodplains are all along the entire vessel corridor to the mouth of the Columbia River, including 68,347 acres within the vessel corridor itself (see Appendix P.3).

No floodplains are in the ocean or near-coastal waters. Areas at destination ports may include floodways, floodplains, or floodplain fringes and often have flood control/protection features that modify the ability of floodwaters and/or tidal surges to inundate floodplains. Areas within vessel corridors at destination ports may be within and adjacent to floodways and floodplains.

Wetlands

The vessel corridor includes many types of wetlands associated with the complex mosaic of topographic, soils, hydrologic, hydraulic, and water quality environments of the Lower Columbia River. Marine, estuarine, lacustrine, and riverine systems are represented. A range of wetland subsystems and classes, including rocky shore and others with limited vegetation, occur, as do those with emergent, shrub-scrub, forested, and aquatic bed vegetation. Natural and modified hydrology and topography, and a wide range of inundation categories from permanent, tidal, and seasonal to temporary and/or artificial are all evident. The NWI maps (see Appendix P.3) indicate the location and distribution of wetland types. The marine environment is only represented in the NWI mapping boundary at the outside margins of the river mouth, since NWI mapping does not include the deepwater marine areas of the vessel corridor. The estuarine environment covers the broad lowlands downstream of Skamokawa with a total of 87,179 acres of estuarine wetlands in the vessel corridor (Table 3.3-15). Approximately 37,199 acres of riverine environments are in the vessel corridor, almost exclusively the tidal zones of the Columbia River, along with some tributary mouths. Lake environments, freshwater ponds, and wetlands with a range of features and conditions form a dense, relatively continuous patchwork along the river and slough margins and across low islands and floodplains (except where isolated by levees and dikes). Overall, about 149,731 acres of the vessel corridor, or nearly 80 percent of it, are identified as wetlands in the NWI (Table 3.3-15).

The mapbooks (Appendix P) and Table 3.3-15 include all identified wetlands in the vessel corridor for reference in impact discussions, although normal operations would not be expected to affect as large an area as would be considered for potential impacts of spills, fires, and explosions (Chapter 4).

The high-quality nature of riverine and estuarine wetlands indicates that these environments are valued for their ability to provide habitat to birds, fish, and other species, and users of water resources who fish or hunt. Wetlands can also reduce sediment loading and remediate some toxics depending on the vegetative and functional regime. They can improve water quality downstream, for instance, at surface water intakes used for drinking water, irrigation, or water quality for contact recreation.

Table 3.3-15. Wetlands in the Vessel Corridor

Wetland Type	Code	Description	Acres in Vessel Corridor
Marine, Subtidal: Unconsolidated Bottom	M1UB	High energy coastline; unconsolidated sediment and less than 30 percent vegetation cover	166
Marine, Intertidal: Rocky Shore, Unconsolidated Shore	M2RS, M2US	High energy coastline between extreme low water and extreme high water and splash zone; unconsolidated sediment and less than 30 percent vegetation cover	35
Marine (subtotal)			201
Estuarine, Subtidal: Unconsolidated Bottom	E1UB	Deepwater tidal and adjacent wetlands, low energy coastlines, permanently flooded by tides, unconsolidated sediment and less than 30 percent vegetation cover	69,192
Estuarine, Intertidal: Unconsolidated Shore, Emergent, Aquatic Bed, Rocky Shore, Scrub-Shrub	E2US, E2EM, E2AB, E2RS, E2SS	Deepwater tidal and adjacent wetlands, low energy coastlines, exposed and regularly flooded by tides; includes the associated splash zone, unconsolidated sediment, and less than 30 percent vegetation cover	17,987
Estuarine (subtotal)			87,179
Riverine, Tidal: Unconsolidated Bottom, Unconsolidated Shore, Aquatic Bed, Rocky Shore	R1UB, R1US, R1AB, R1RS	Continuously flowing in natural or artificial channels, between estuarine and upper extent of tidal fluctuations; low gradient	37,021
Riverine, Lower Perennial: Unconsolidated Bottom	R2UB	Continuously or periodically flowing in natural or artificial channels, connecting bodies of water low gradient; unconsolidated bed of sand and mud and less than 30 percent vegetation cover	102
Riverine, Upper Perennial: Unconsolidated Bottom	R3UB	Continuously flowing in natural or artificial channels, high gradient, rock, cobble or gravel bed, and less than 30 percent vegetation cover	17
Riverine, Intermittent: Streambed	R4SB	Periodically flowing in natural or artificial channels, flowing only part of the year, completely dewatered at low tide, and seasonally flooded	59
Riverine (subtotal)			37,199
Lacustrine, Limnetic: Unconsolidated Bottom	L1UB	Deepwater lake, unconsolidated bed, less than 30 percent vegetation cover, permanently flooded, including diked and impounded	179
Lacustrine, Littoral: Unconsolidated Bottom, Aquatic Bed, Emergent	L2UB, L2AB, L2EM	Vegetated habitats on lake margins: shoreward bound to 6.6 feet below annual low water, erect, rooted, herbaceous plants, perennial but not persistent	244
Lacustrine (subtotal)			423

Table 3.3-15. Wetlands in the Vessel Corridor

Wetland Type	Code	Description	Acres in Vessel Corridor
Palustrine, Aquatic Bed	PAB	Freshwater wetland and deepwater with plants growing on or below the water surface, artificially flooded	16
Palustrine, Emergent	PEM	Freshwater wetland/pond with erect, rooted, herbaceous plants, mostly perennial; including seasonally flooded	7,536
Palustrine, Scrub-Shrub	PSS	Freshwater wetland/pond dominated by woody species less than 20 feet tall, including seasonal-tidal	5,020
Palustrine, Forested	PFO	Freshwater wetland/pond dominated by woody tree species 20 feet tall or higher	5,750
Palustrine, Unconsolidated Bottom	PUB	Freshwater wetland/pond with bed with at least 25 percent cover of particles smaller than stones and less than 30 percent vegetative cover	219
Palustrine, Unconsolidated Shore	PUS	Freshwater wetland/pond with less than 75 percent stones, boulders, or bedrock and less than 30 percent vegetative cover, including seasonal-tidal	189
Palustrine (subtotal)			18,730
Total			143,731

Source for Wetland Types: Cowardin et al. 1979

Note:

M1UB = marine, subtidal, unconsolidated bottom; M2RS = marine, intertidal, rocky shore; M2US = marine, intertidal, unconsolidated shore; E1UB = estuarine, subtidal, unconsolidated bottom; E2US = estuarine, intertidal, unconsolidated shore; E2EM = estuarine, intertidal, emergent; E2AB = estuarine, intertidal, aquatic bed; E2RS = estuarine, intertidal, rocky shore; E2SS = estuarine, intertidal, scrub-shrub; R1UB = riverine, tidal, unconsolidated bottom; R1US = riverine, tidal, unconsolidated shore; R1AB = riverine, tidal, aquatic bed; R1RS = riverine tidal, rocky shore; R2UB = riverine, lower perennial, unconsolidated bottom; R3UB = riverine, upper perennial, unconsolidated bottom; R4SB = riverine, intermittent, streambed; L1UB = lacustrine, limnetic, unconsolidated bottom; L2UB = lacustrine, littoral, unconsolidated bottom; L2AB = lacustrine, littoral, aquatic bed; L2EM = lacustrine, littoral, emergent; PAB = palustrine, aquatic bed; PEM = palustrine, emergent; PSS = palustrine, scrub-shrub; PFO = palustrine, forested; PUB = palustrine, unconsolidated bottom; PUS = palustrine, unconsolidated shore.

3.3.3 Impact Assessment

All impacts to water resources are evaluated here except for an evaluation of proposed wastewater discharges and impacts to public sewers, which is included in Section 3.15 and impacts from large spills, fires, or explosions, which are addressed in Chapter 4.

3.3.3.1 Proposed Facility

Construction

Surface Water

Short-term disturbance of the Columbia River bed would occur during temporary pile installation and marine terminal improvements. These activities would cause temporary increases in turbidity. Construction BMPs including sediment and erosion controls, such as an in-water boom and curtain, would be deployed if necessary to limit sediment migration downstream.

The USACE is also reviewing proposed modifications to Berths 13 and 14 through an application for US Department of the Army authorization under CWA Section 404 and Rivers and Harbors Act Section 10. The Applicant submitted an application to the USACE on February 12, 2014, describing seismic and safety upgrades, installation of concrete anchors to existing steel piles, minor configuration modifications to existing mooring facilities, and installation of a transfer pipeline on one of the mooring facility piers (Berth 14) (USACE 2015b). As of the publication date of this Draft EIS, the permit application is still under review.

Above-water work would use temporary construction containment and work platforms, which would be built on temporary construction piles to reduce potential releases of construction materials into the Columbia River. Monitoring of water quality during installation and removal of temporary piles would be conducted. Where necessary, construction methods would be modified to protect surface water quality. Construction debris and wastes would be collected and disposed of at an approved location and would not be permitted to enter the watercourse, which would reduce the potential for degradation of water quality from construction of dock modifications.

Implementation of the construction BMPs and water quality monitoring described above would limit impacts to surface water during construction to temporary and minor to moderate levels.

Stormwater

If not managed properly, stormwater runoff from the proposed Facility site during construction could adversely affect surface water quality by introducing sediment and pollution into nearby waterways. Stormwater discharges from the site during construction would be subject to an Individual Construction NPDES permit conditioned by EFSEC. As part of that process, an approved construction phase SWPPP (see draft SWPPP in Appendix D.7) would describe the site and proposed construction in detail and identify erosion, sediment, and stormwater controls for each activity. The SWPPP would also address temporary staging, storage, and access areas.

The Applicant proposes to implement site-specific avoidance measures to minimize the disturbance of existing capped or contaminated areas to avoid disturbing or releasing contaminated material back into the environment via stormwater. In areas where construction activities would disturb existing capped or contaminated areas (to modify the underdrain and high-density polyethylene [HDPE] liner), stormwater discharges would be rerouted to avoid conflicts and remain functional but separate from future stormwater systems.

Construction activities would be sequenced to limit the potential for erosion and sediment transport in stormwater runoff. This includes the establishment of BMPs before clearing, excavation, and grading, clearing and grading small portions of the site at a time, and stabilizing all nonactive disturbed areas in accordance with the individual permit that would be issued. Currently, the Applicant proposes to comply with the terms of the 2010 Construction Stormwater General Permit,[6] which specifies that soils may not remain exposed and unworked for more than 7 days in the dry season (May 1 to September 30) and 2 days in the wet season (October 1 to April 30). The Applicant has proposed sediment control measures to be used throughout the site based on a 10-year design storm. Stormwater hydrology includes all construction phase areas and wet-weather assumptions.

Erosion control measures would include temporary soil stabilization measures such as straw matting and erosion control blankets, to prevent erosion and promote dust control. Other BMPs that the Applicant describes in their draft SWPPP (BergerABAM 2015b) include protecting natural features and preserving vegetative buffers through delineation of the site with high-visibility fencing; installation of storm drain inlet protection; erecting silt fence, especially at the bottom of slopes in the storage area (Area 300) and marine terminal (Area 400); controlling flow rate with check dams (unloading and office area [Area 200]), outlet protection (marine terminal [Area 400]), compost socks (in the marine terminal [Area 400],

6 The 2010 permit will expire on December 31, 2015. A new Construction Stormwater General Permit will go into effect January 1, 2016.

transfer pipelines [Area 500], and boiler building [Area 600]), and custom tank storage (unloading and office area [Area 200], storage area [Area 300], and marine terminal [Area 400]); providing stabilized construction entrances with wheel washes; covering construction and landscaping stockpiles; and additional sediment removal BMPs and turbidity control BMPs that may include custom measures such as weir tanks, filtration, and chemical treatment (if approved by Ecology, the Port, and the City).

Water quality monitoring during construction may require modifications to the SWPPP monitoring plan, including locations, since discharge points may change for various phases. Generally, monitoring structures would be installed at each connection location where the Project discharges to the Port's existing downstream conveyance and treatment systems. During construction, the Applicant would monitor daily for turbidity (relative to a 25 Nephelometric Turbidity Units benchmark) and weekly for pH during concrete pouring and curing (relative to an 8.5 pH maximum). Monthly discharge monitoring reports would be submitted electronically to EFSEC, and if any terms and conditions of the permit were not met, several notification and control steps could be taken and written reports submitted outlining the noncompliance and response.

Dewatering activities (expected in the unloading and office area, storage area, and marine terminal) include control measures such as chemical filtration, stormwater filtration, and custom weir tanks installed before ground disturbance occurs, and pumped water would be tested for water quality prior to release into the construction stormwater system. Groundwater removed from contaminated areas (Restrictive Covenant Areas) would be tested for specific pollutants of concern (Table 3.3-16) to determine appropriate disposal methods. If the pumped water were to meet the City's disposal criteria, it would be treated onsite and disposed of via the City's sanitary sewer system. If the dewatering water exceeded the City or state criteria, it would be removed by a licensed commercial waste disposal facility for offsite treatment and disposal.

Soil encountered in restricted areas and any suspected contaminated soil or water would be handled in accordance with procedures in the approved Contaminated Media Management Plan, including transport for disposal at a lined container or stockpile or permitted offsite facility (Appendix D.8). Excavated soils would be deemed suitable for reuse on the Port only if the Washington State Model Toxics Control Act and Port fill acceptance criteria were met. See Section 3.8 for additional discussion on contaminated soils.

Table 3.3-16. Groundwater Contaminant Testing for Specific Restricted Areas

Restricted Areas	PAHs	VOCs	Metals	PCBs	Cyanide	Fluoride	Petroleum Hydrocarbons
Vanexo Cap				X		X	
Spent Pot Liner Cap						X	
Ingot Plant Cap				X		X	
North/North 2 Landfill		X		X		X	
East Landfill	X	X		X		X	

Source: BergerABAM 2015c

PAHs = polycyclic aromatic hydrocarbons, PCBs = polychlorinated biphenyls, VOCs = volatile organic compounds

Small pollutant discharges may occur from spills and leaks of petroleum products and lubricants, such as from fueling construction vehicles and equipment. Leaks and drips can reach surface water directly or through stormwater runoff. However, construction BMPs would be put in place to reduce these effects. BMPs include staging equipment when not in use in a specified area, using duck ponds/catch basins below equipment staged, and regular monitoring and inspections of equipment for leaks. Impacts to water quality from small spills and leaks of hazardous materials are expected to be minor.

Ground improvements are proposed to strengthen the soil under many Facility structures in various areas (see Section 2.3.2.2), using construction methods determined based on final geotechnical analysis of site conditions and approval by EFSEC. The ground improvements may have short-term impacts to surface water quality, particularly since vibroreplacement stone columns, jet grout columns, and deep soil mix columns would be installed adjacent to the OHWM along the Columbia River (McCabe 2015). Adverse impacts related to the use of cementitious grout in the soil, added water at elevated pressure, and/or vibration or rotary probes could occur. Cement mixes can significantly raise the pH and turbidity of water contacted. Muddy water brought to the surface could enter the stormwater conveyance systems and impact water quality if not properly handled. Vibration may affect the ground stability and/or turbidity and total suspended solids. Groundwater affected by these processes could also convey contaminants toward the Columbia River.

The Applicant proposes the following measures to reduce the likelihood that ground improvement activities would release contaminants into the Columbia River:

- Install temporary sheet pile wall between the jet grout installation areas and the OHWM with sufficient freeboard to contain slurries and spoils and prevent them from entering the Columbia River.
- Sequence the construction of the permanent ground improvements such that the first installations nearest to the OHWM become an additional buffer along with the sheet pile wall.
- Provide isolation measures to contain, extract, and dispose of spoils
- Capture and treat high pH water.
- Conduct water quality monitoring.

Even with the application of these measures it is possible that muddy groundwater or jet water brought to the surface and cement mixes that raise the pH and turbidity could enter the Columbia River in stormwater resulting in minor to moderate impacts.

Upland construction activities include erecting buildings and installing equipment. These activities would occur after the majority of land alterations and site stabilization activities have taken place. Therefore, the risk of spills and leaks entering waterways during this phase would be reduced due to the previous installation of stormwater controls. However, concrete slabs for buildings would potentially require the excavation of soil and the laying down of cement mix.

Water used for hydrostatic testing of the storage tanks and pipelines (approximately 20 million gallons) has the potential to impact surface water as it would likely be an allowed nonstormwater discharge under the stormwater discharge permit issued by Ecology. Hydrostatic testing water discharges would be analyzed and treated, if necessary, prior to discharge into onsite stormwater systems in compliance with the EFSEC individual stormwater permit. Testwater for the potable water and wastewater service extensions that is superchlorinated for disinfection would be dechlorinated prior to discharge to the sanitary sewer. Treatment prior to discharge would comply with the pretreatment permit from the City. These methods are further discussed in Section 3.15.

Implementation of the Applicant-proposed stormwater BMPs, slurry and spoils control measures, treatments for hydrostatic testwater, and water quality monitoring described above would limit impacts to surface water during construction to temporary and minor to moderate levels.

Groundwater

Construction-related dewatering activities at the proposed Facility have the potential to result in the temporary local drawdown of groundwater immediately surrounding dewatered work sites. However, these actions would not result in impacts to long-term groundwater abundance and availability in the area. Most of the excavations would be shallow (less than 5 feet) although in several areas, deeper excavations (approximately 15 feet) would be required. Excavations are likely to be in soils composed of silts, fine sands, and clays that have a relatively low permeability (in the upper 25 feet). Because of this soil composition, the impacts of dewatering operations are likely to be limited to localized areas surrounding the activity, even in deeper excavations.

Contaminated groundwater may be extracted during construction dewatering operations in areas with contamination, which may expose personnel and construction workers to such contamination. Impacts to the health and safety of workers is addressed in Section 3.8. Groundwater in locations with deed restrictions and at risk of being contaminated would be contained, tested for specific parameters (Table 3.3-16), and treated prior to discharge. If required water quality limits were not met, pumped water would be hauled to an offsite treatment facility approved by Ecology or EPA and not discharged.

Many proposed construction BMPs to protect surface water would also minimize the opportunity for contaminated surface water to enter groundwater, including spill and leak prevention, housekeeping, grading limits, coverage and temporary erosion control, and special measures to be undertaken in deed-restricted areas. Prevention of ponding water that would promote leaching, temporary covers over disturbed areas, and controlling tracking of contaminants from one portion of the site to another are additional BMPs the Applicant would undertake that are particularly important for protecting groundwater.

The 2011 Final Supplemental Cleanup Action Plan (Ecology 2011) includes monitored natural attenuation that would continue until groundwater cleanup standards are achieved (at the Spent Pot Liner and East Landfill, only). Construction activities could impede monitoring by limiting monitoring access to existing water supply wells and monitoring wells. A temporary impact to monitoring activities could result from restricted access during particular calendar quarters.

Ground improvements are proposed to strengthen the soil under many Facility structures in various areas. The ground improvements may have short- or long-term effects on groundwater conditions and/or water quality. Short-term impacts are discussed here, with any long-term impacts described under operations.

The vibroreplacement stone column ground improvement technique uses potentially large volumes of water during construction to aid in the densification process. Although clean water would be used in the process, excess production water with high total suspended solids content would ultimately be released through the boring column/probe hole to the surface. Also, during the installation of the vibroreplacement stone columns, wick drains are used to allow water to migrate rapidly out of the soil. The vibroreplacement columns may act as pathways for surface contaminants to reach lower portions if these columns are not capped/sealed as part of the construction process.

The high suspended solids content of the production water could impact local groundwater, particularly if released to the highly permeable Deep or Aquifer zones, and less so if released to the less-permeable Intermediate Zone. The relatively shallow water supply wells at the eastern end of the Port are located up- or side-gradient and at some distance from the construction and are unlikely to be impacted by ground improvements. The CPU wells at the generating plant, although close to the construction, are screened at deep depths and are unlikely to be impacted. In addition, vibroreplacement can increase the vertical hydraulic conductivity in the columns, which could create a conduit for contaminants from the surface to lower formations. The Applicant would take extra precautions, such as the perimeter controls (silt fence and compost sock) described in the preliminary SWPPP, in areas where ground improvements would occur to minimize vertical migration of inadvertent spills and releases.

Wet and dry soil mixing and jet grouting ground improvement techniques involve the injection of a cementitious binder (either in a dry state or a slurry) into the soil to form a soilcrete column. Uncontrolled hydration of cement can result in the release of high pH liquids and metals, which can impact localized groundwater quality, although the introduction of a large volume of water would be required for this to occur. Once cured, the soilcrete columns could have a limited and localized impact to soil alkalinity. Depending on the location, size, orientation and depth of soilcrete columns, groundwater elevations, gradients, and local flow directions could be impacted (see Operations and Maintenance).

Implementation of the Applicant-proposed construction BMPs, EFSEC proposed mitigation measures and extra precautions to be taken in areas where ground improvements would occur would limit impacts to groundwater during construction to temporary and minor to moderate levels.

Floodplains

Certain construction elements of the marine terminal improvements would occur within FEMA-designated floodway (Figure 3.3-10). Temporary piles may be installed to facilitate the proposed modifications to the existing dock. New piles would be installed for the proposed mooring points. Construction of the new abutment, upland mooring points, and movable walkway foundations may encroach below the 100-year water surface elevation, but would be located within the existing embankment. Berths 13 and 14 in the marine terminal (Area 400) are existing pile-supported structures located in the Columbia River.

Portions of the proposed upland structures located in the marine terminal (Area 400) would be constructed in the 100-year floodplain (Figure 3.3-10). According to the preliminary SWPPP, upland electrical gear and the MVCUs would be located on slab-on-grade foundations. The fire pump and foam building and the two story E-house/control room would be located on drilled piers.

Although a portion of the storage area is within the 100-year floodplain, the containment berm would be approximately 6 feet above the existing ground elevation, which would prevent the interior from inundation during a 100-year flood event. The transfer pipeline route also crosses isolated floodplain and would be elevated on spread footings designed to withstand flooding. All other proposed Facility elements would be located outside the limits of the 100-year floodplain.

Construction equipment, materials, and workers present within the 100-year floodway could be subject to hazards from floodwaters. However, the probability of a 100-year (1.0 percent annual chance) flood event occurring during an active construction window is low. Monitoring of weather, river discharge, dam operations, and flood warnings would be used to inform the construction schedule. Temporary demobilization of equipment, materials, and workers from the 100-year floodplain would reduce the risks.

In the unlikely event of a 500-year flood, inundation of 1 to 3 feet at the proposed Facility would result in submergence of the containment trenches and railcar unloading area. Similarly, the marine terminal facilities constructed at-grade may be impacted by 1 to 3 feet of inundation from a 500-year flood. The storage area would be inundated outside of the limits of the containment berm and may impact supporting facilities. The berm would be approximately 6 feet above the existing ground elevation, which would restrict the interior 16± acres from inundation during a 500-year event. However, the probability of a 500-year (0.2 percent annual chance) flood event occurring during particular construction activity windows would be extremely low. In the event of a 500-year flood, to the extent possible, hazardous material and equipment would be demobilized from the site and relocated above the 500-year floodplain. During demobilization, all construction equipment that could not be removed from the Project site would be secured to the extent possible. Overall, impacts to floodplains or impacts to construction activities from flood events would be minor as it is anticipated that time would be adequate to secure the proposed Facility during a high flood event.

Wetlands

No wetlands are present on the proposed Facility site (Figures 3.3-11 and 3.3-12), and buffers for the adjoining wetlands do not extend onsite; therefore, Project construction would not directly disturb wetlands or involve work within wetland buffers. However, offsite wetlands could be affected by construction if stormwater runoff were not properly managed and/or through temporary changes in wetland hydrology from the installation of vibroreplacement stone columns.

Perimeter control measures and BMPs would be sufficient to mitigate impacts. The SWPPP would ensure that stormwater runoff did not discharge to wetlands or wetland buffers during construction. Additionally, a Spill Prevention, Control, and Countermeasure (SPCC) Plan would define specific BMPs to minimize the potential for leaks and spills, as well as minimize the extent of damage from any unavoidable leaks or spills from construction equipment. They include locating temporary material and equipment staging areas above the OHWM of the waterbody and outside environmentally sensitive areas, including wetlands and regulated wetland buffers.

Wick drains would be installed in areas of proposed ground improvements to reduce the risk of water and/or air moving laterally underground. Further, visual inspection of adjacent wetlands would occur daily to look for signs of lateral movement of water and/or air used during the installation process that could negatively affect adjacent wetlands. Any observation of water or air movement would result in temporary suspension of installation activities until counteractive measures (such as additional wick drains) could be installed.

Based on the location of construction activities relative to the adjoining wetlands, the planned BMPs, and the Applicant-proposed monitoring and inspection programs, proposed Facility construction impacts to wetlands would be negligible.

Operation and Maintenance

Surface Water

Large vessels calling at the proposed Facility may have drafts of 41 feet when fully loaded, which would come close to the bottom of the river channel at low-flow levels. The navigation channel of the Columbia River near the Port is maintained at a depth of 43±2 feet, but river levels can run below the mean lower low water depending on upstream dam operations and weather (see Chapter 2 for additional specifications regarding navigation).

Maneuvering of vessels near the marine terminal, particularly those in the large vessel class, could generate waves and modify currents that could churn and locally mobilize bed sediment of the Columbia River (Houser 2011). Waves that break on or over the shoreline could affect erosion and sedimentation, primarily on the few vulnerable portions of the streambank at the Port (most of the bank is protected with cobble and riprap) and the northern portion of Hayden Island, where the shoreline consists of unconsolidated sediment. The movement of water from vessel propellers and assist tugs could also result in movement of sediment from the river bottom in locations where vessels are positioned and docked by tugs.

Vessel maneuvers at the marine terminal would be conducted at low speed, but due to the channel size and draft of vessels calling at the proposed Facility, turbulent mixing could still occur, resulting in a temporary increase in localized surface water turbidity. Small discharges of petroleum products, lubricants, and other chemicals could also occur from small spills and leaks in upland areas or near surface waters during operation and maintenance activities, potentially affecting surface waters. Because increases in turbidity from vessel maneuvers at the marine terminal would be temporary and any small spills or leaks to the river would be quickly diluted, impacts to surface water during normal operation and maintenance activities would be minor.

Stormwater

Impacts to surface water could result from improper capture of stormwater runoff volumes and peak flows, and/or insufficient treatment capability of onsite stormwater systems that could result in erosion and sediment transport, conveyance of inadvertent product/hazardous material releases, and release of untreated stormwater to the Columbia River over the life of the Project. However, the design of proposed stormwater system modifications and improvements at the proposed Facility would reduce the potential for such impacts. Stormwater would be managed separately from industrial process water and domestic wastewater flows. Maintenance, including equipment and parts washing areas, would be conducted in a covered portion of the railcar unloading facility. All wastewater produced would be pumped to the secondary containment tanks and hauled offsite to a permitted disposal or recycling facility.

All proposed Facility stormwater conveyance systems would be designed to handle the 25-year, 24-hour storm without exceeding 75 percent pipe capacity. The proposed Facility land cover conditions would reduce the overall percentage of impervious surface to 93.7 percent, and the resulting post-Project runoff peak flows would range from 15.23 cfs for the 2-year event to 36.86 cfs for the 100-year event. Upon Project completion, the overall 100-year peak runoff from the site would be slightly less than the present amount. As such, the proposed Facility stormwater conveyance systems could accommodate a 100-year event.

Stormwater quality compliance would be achieved through a combination of source control, and structural and operational BMPs (pursuant to an approved operations SWPPP). The primary design approach of the proposed Facility's specific system is to limit the potential for stormwater to interact with industrial activities and areas, to provide capture and removal options, and to provide passive pretreatment for any waters discharged to the Port's stormwater system (Table 3.3-17). Stormwater inlets at the site would be confirmed to have, or be retrofitted with, spill containment devices, which would prevent stormwater contamination onsite. The typical containment device is a "T" or "90 degree" elbow installed on the outlet pipe to prevent crude oil from entering the outlet. Final design and maintenance requirements would be completed in consultation with the Port, as the Port owns the stormwater conveyance systems and outfalls. Passive treatment units, including oil-water separators, oil traps, and cartridge filter vaults would be used for treatment to ensure that compliance with water quality standards and discharge limits for the proposed Facility and Port NPDES permits would be met.

The proposed passive treatment systems are designed to require minimal operational input and maintenance to function. Normal and preventive maintenance of all stormwater drainage and treatment systems would include regular inspection and cleaning, repair of any components, regular removal of debris and sludge, and appropriate signage, training, and housekeeping measures. Water quality observation, sampling, and monitoring under an approved operations SWPPP would be conducted. Stormwater monitoring would occur at the proposed Facility's connections to the Port system, including at manhole locations in the unloading and office area (Area 200) downstream of proposed treatment vaults from the railcar unloading facility; manhole locations in the storage area (Area 300) downstream of proposed treatment vaults; a monitoring manhole upstream of discharge to the biofiltration swales; and at a proposed treatment vault from the marine terminal containment area. Discharges of stormwater from the proposed Facility would meet water quality benchmarks consistent with the Industrial Stormwater General Permit.

Table 3.3-17. Proposed Facility Stormwater System Features

Port Stormwater Basin/Discharge	Stormwater Design Features
Terminal 5 Stormwater System	Stormwater from the administration and support buildings and the rail unloading facility, as well as from the boiler building, would be treated onsite and discharged to the existing stormwater system. Landscaping at the building areas would facilitate natural drainage and infiltration from nonpolluting surfaces. Stormwater from roofs would be collected for direct discharge to the stormwater system without pretreatment. The rail unloading pumps, containment trenches, and conveyance pipelines would be located fully within the rail unloading facility, to shelter those facilities from precipitation. The interior rail unloading area would have rail drip pans, containment trenches, and a perimeter curb. Double-walled containment tanks would be installed to receive water from trenches and drainage within the railcar unloading facility; oily water would be vacuumed, removed, and disposed of offsite. StormFilter vaults would be installed to pretreat discharge, and stormwater from top of the Vanexco Cap liner and existing NGL Supply would be rerouted without any comingling with pollution-generating surfaces at the proposed Facility. Discharge from the proposed Facility to the Port system would occur at two locations upstream of the water quality ponds west of Terminal 5.
Terminal 4 Stormwater System	The storage tank containment area would have intermediate and central containment berms, spill traps, control valves and oil-water separator baffles, and coalescing plate separators to pretreat prior to pump station discharge to the stormwater system. The containment berm would be sized to store 110 percent of the contents of one tank, plus a 100-year rainfall event volume. The storage tanks would have fixed exterior roofs and gutters to capture and route rainwater to stormwater systems prior to any opportunity for contact with crude oil. The pump station would discharge to a StormFilter vault prior to comingling with runoff from the parking lot and support area. The pump basin for the crude oil transfer pumps that transfer to the marine terminal would be in the containment area, and would discharge through an oil-water separator prior to discharge to the City's sanitary sewer.
Marine Terminal Infiltration Swales	Electrical and mechanical equipment would be contained within upland structures, and the MVCUs would be on concrete pads. Landscaping would be provided between the top of bank and access road where feasible, and other remaining upland areas would be graded to drain to the swales (rather than overland to the river). The access driveway would be retrofitted with a media filter drain to treat sheet flow. The replaced trestle section would continue to sheet flow toward the river but would not be used for regular vehicular traffic. A portion of the existing treatment bioswale would be removed; a filter strip would be installed to replace its function. Collection and containment would be provided at the face of the dock, encompassing all fittings, hoses, and mechanical equipment with a 350-bbl containment volume; if no oil sheen were present, stormwater would be treated by oil-water separator and a series of water quality vaults before pumping to the biofiltration swale system. If oil sheen were present in the containment area, the stormwater would be removed and disposed of properly without discharge to the infiltration swales. Stormwater facilities serving the transfer pipeline sections would be retrofitted with oil catch basins, and the pipes would have leak detection monitoring systems.

Source: BergerABAM 2015a

bbl = barrel(s), MVCU = marine vapor combustion unit

Rail operations in general (freight or passenger) can contribute pollutants from direct transportation activities (brakepad consumption, locomotive lubrication, and fuel drips) and from activities on paved roads and surfaces associated with railroad operation and maintenance of railroad rights-of-way (Puget Sound Regional Council 2010). Small crude oil leaks or spills could include drips resulting from nicks, corrosion pinholes, or gasket seal failures, resulting in discharges less than 5 gallons. Containment and routine inspections should be sufficient to mitigate any impacts from these occurrences. Response to any reportable spills would be performed within the parameters and protocols of the Facility's approved SPCC Plan.

A portion of the transfer pipeline alignment (Area 500) would include secondary containment and would be subject to inspections and contingency planning. Spill control devices on existing stormwater inlets would be installed to contain small oil leaks or spills.

Impacts to surface water temperature are not anticipated from the proposed Facility as currently designed. The construction of additional landscaping would increase existing shading and canopy, and provide for increased natural absorption, runoff reduction, and lower temperatures. Contact of stormwater from heated system elements, including storage tanks and pipelines, would be eliminated by insulating those tanks and pipelines. Steam condensate discharges from the unloading and office area (Area 200) and the boiler building (Area 600), which could be hot, would discharge to sewer.

Because the modified stormwater system at the proposed Facility would capture anticipated stormwater runoff volumes and peak flows, would include a variety of pretreatment systems to prevent sediment transport and the conveyance of inadvertent hazardous material releases to the Columbia River, and because the Applicant would conduct regular water quality observation, sampling, and monitoring under an approved operations SWPPP, the impacts to water resources from stormwater discharges from the proposed Facility would be minor.

Groundwater

The proposed ground improvements to address geotechnical and seismic hazards would result in permanent changes in the subsurface characteristics, including material composition, density, porosity, and possible groundwater flow paths. The volume of space represented by the proposed Facility ground improvements is negligible compared to the size of the entire TAS, and is at the downgradient margin of the aquifer; therefore, only negligible effects to groundwater elevations, gradients, or flow paths would be expected relative to the overall TAS. However, permanent local impacts to groundwater conditions could result.

In the storage area (Area 300), stone columns would range in depth from 35 to 43 feet bgs under the tanks, and 25 to 47 feet bgs under transfer pipelines. In the marine terminal (Area 400), improvements under the pipeline may extend to 45 feet bgs, and jet grout columns would extend to about 78 feet bgs for the improvement zone parallel to the dock. The total volume occupied by columns and their spacing would influence groundwater elevations and flow routing in the vicinity of the storage area and the marine terminal, potentially reducing gradients toward the river on the landward side of the ground improvements ("slowing and mounding" the water) and redirecting flow paths around and between improvements. While these localized changes in groundwater conditions may be measureable, they would not adversely affect the overall groundwater discharge to the Columbia River or the water available for extraction at Port or City water supply wells.

The dense ground improvement columns would extend to depths of 35 to 78 feet bgs and could provide new vertical pathways for water movement, either through infiltration from the surface to subsurface, and/or through exchange of groundwater between subsurface layers. Contaminants released from the surface that reach the Shallow zone would likely flow toward the Columbia River. If contaminants were to reach the Intermediate or Deep zones, it is possible that large wells on the Port property or in the surrounding area could draw the contaminants away from the proposed Facility site and/or comingle with contaminants in remediation areas. However, the impacts from vertical movement of water and migration of contaminants would be minor, since the ground improvements would be located, by engineering function, below areas that would have impervious surfaces, structures, or caps. The bermed secondary containment area would be lined with an impervious membrane. Further, all of the design elements and operational BMPs that minimize risks of contaminants entering stormwater would also limit the potential for contaminants to reach the subsurface groundwater and move toward and/or along the vertical columns.

Driven piles and spread footings are not anticipated to have an impact to groundwater conditions or water quality due to their methods of installation, materials, and depths. Further, concrete slabs for buildings would have a liner underneath them preventing the downward migration of high pH liquids into groundwater. No permanent Proposed Action facilities are planned that could impede access to and monitoring of groundwater in deed-restricted areas through existing water supply wells or monitoring wells. Overall, impacts to groundwater from operations and maintenance activities would be minor.

Floodplains

The marine terminal improvements would be located within the FEMA 100-year floodplain and floodway (Figure 3.3-10). No additional permanent piles would be installed below the OHWM of the Columbia River, and walkways, trusses, and dock modifications would not create a net increase in permanent structures or appurtenances within the floodway. It is not anticipated that any net fill would be placed in the floodplain fringe or floodway. Therefore, the proposed Facility would not result in a net rise of the base flood elevation (i.e., 100-year flood).

The existing and planned improvements to Berths 13 and 14 would be located with deck elevations above the 100-year flood elevation and would be designed by a professional engineer to withstand the forces imposed by floodwaters. However, the dock transformer pad, control room/E-house, and fire pump and foam building in the marine terminal (Area 400) would be located in the 100-year floodplain. According to the Applicant, these structures would be elevated so that the floor is at least 1 foot above the base flood elevation. They would also be anchored to resist movement and built with utility connections that are designed to withstand flood events (BergerABAM 2014).

The transfer pipeline route crosses a portion of the 100-year floodplain that is isolated from overland flows from the Columbia River so it would not likely be subject to flowing water. Regardless, the pipeline would be designed by a professional engineer to withstand impacts from flooding. All other Facility structures and buildings in upland area would be located outside the limits of the 100-year floodplain (Figure 3.3-10).

In the unlikely event of inundation from the 500-year event, water depths between approximately 1 and 3 feet could occur over portions of the site (Figure 3.3-10). The containment berm and the marine terminal would be designed to maintain integrity under the 500-year flood conditions. However, the railcar unloading facility would be located within the inundation area of the 500-year floodplain. Trenches located within the railcar unloading facility would be submerged. Floodwaters entering the trenches could come into contact with oil residues if such residues were present within the trenches. However, a 500-year flood (0.2 percent annual chance) event would have a very low probability of occurrence over the 20-year timeframe of the proposed Facility. Overall, impacts to floodplains, or impacts to construction activities from flood events, would be minor.

Wetlands

No wetlands are present at the proposed Facility, and wetland buffers for the adjoining wetlands do not extend onsite; no permanent fill or dredge would impact wetlands or their buffers. Wetlands in the vicinity have the potential to be indirectly impacted by operations only if measures to avoid or mitigate surface water quality and groundwater quality effects are not successful. The proposed Facility's design elements to contain stormwater, the operations and maintenance activities to protect surface water and groundwater, and the monitoring, reporting, and any adaptive management required under the industrial stormwater permit would minimize operational impacts to wetlands adjacent to the proposed Facility. Therefore, impacts to wetlands from proposed Facility operation and maintenance would be negligible.

Because emergent wetlands vegetation is absent along the north bank of the Columbia River and nearly all of the north side of Hayden Island and because vessels would operate at very low speeds in the vicinity of the terminal, impacts to wetlands from vessel operations would be negligible.

Decommissioning

Surface Water

Impacts to surface water associated with proposed Facility decommissioning are anticipated to be less than those related to construction activities (i.e., impacts from the discharge of sediment or turbidity during land disturbing activities, or from drips and leaks associated with equipment use). A site restoration plan would be submitted for review and approval by EFSEC if the Site Certification were to be terminated; if more than 1 acre of land were disturbed during decommissioning, the proposed Facility would need to obtain a construction NPDES for activities and implement an approved SWPPP including appropriate BMPs for control of surface erosion, sedimentation, and/or stormwater contamination that can enter surface waterbodies. Implementation of the construction BMPs and water quality monitoring similar to that described above for construction would limit impacts to surface water during decommissioning to minor levels.

Stormwater

Contaminants may accumulate in oil-water separators and other secondary containment systems during site operations. Stormwater collection and treatment systems that are planned to be retained may require cleaning to eliminate accumulated materials. However, such cleaning would be part of normal stormwater maintenance. System components removed during decommissioning would be cleaned and contaminants appropriately disposed of offsite. Careful demolition and extraction of such systems would be completed under conditions of an approved SWPPP to ensure that accumulated residues would not enter remaining stormwater systems.

Decommissioning activities would primarily be removal of aboveground features, while belowground elements would be retained in place; ground stabilization would be applied. Therefore, only very limited ground excavation/subsurface disturbance would be expected. Control measures, such as silt fence and other BMPs, would be put in place pursuant to an approved SWPPP to limit potential for disturbed soils to contaminate stormwater runoff. These measures would limit impacts from stormwater during decommissioning to minor levels.

Groundwater

Impacts to groundwater associated with decommissioning of the proposed Facility related to vehicles, equipment, and materials handling would be similar to those from construction activities (i.e., impacts from spills from equipment, dewatering, and disturbance of contaminated areas). Materials, including hazardous materials, accumulated in tanks, pipelines, containment systems, and equipment during site operations could be released to the environment during demolition if not managed appropriately. Such a release could result in untreated discharges to the ground, which if left unmanaged, would likely result in soil contamination and possibly leaching into groundwater. Accumulated material would be removed and disposed of in accordance with state and federal regulations. A Site Inspection and Sampling Plan would be developed prior to decommissioning to identify areas where contaminants could be trapped. These areas would be inspected and sampled to identify handling and disposal requirements.

Hazardous materials accumulated in or around secondary containment systems could be exposed during structure demolition and would need to be removed and disposed of at an approved location in accordance with state and federal regulations. Following the removal of tanks and containment structures that housed hazardous materials and crude oil, subsurface soils would be sampled and remediated as necessary.

Since decommissioning does not include plans for removal of most subsurface elements, including ground improvements, decommissioning activities would not include extensive excavations, removal of native or placed artificial materials, or import of fill. Therefore, the potential for decommissioning to result in impacts to groundwater conditions would be minor. The operational impacts of the proposed Facility on groundwater aquifer properties and flow paths (described above) would continue. Additionally, in areas where subsurface systems include vertical pipes or columns, removal of surface elements and concrete slabs could expose the subsurface systems and/or breach protective seals. If subsurface columns were left in place and partially exposed, this could provide a conduit for surface contaminants to enter and move through groundwater, resulting in minor impacts to groundwater.

Floodplains

No functional change to the Columbia River 100-year floodway or 500-year floodplain would occur as part of decommissioning. Decommissioning of the marine terminal dock would be limited to removal of superstructure and crude handling equipment. New mooring dolphins, trestle, dock, abutment, and walkways would remain without any substantial effect on the 100-year floodway or 500-year floodplain. Decommissioning of the upland proposed Facility elements may not necessarily result in the removal of the storage tank area containment berm. If the containment berm remained, the modified (reduced) 500-year floodplain boundary would remain. If the containment berms were removed, the 500-year floodplain boundaries would revert to the present (affected environment condition) and include all of Parcel 1A/the storage area (Area 300).

Onsite decommissioning activities would not require adjustments in the event a 100-year year flood were predicted, since all work would take place above the 100-year floodplain. In the unlikely event that a 500-year (0.2 percent annual chance) flood event were predicted during the decommissioning period, a temporary work cessation would be implemented. Temporary removal of materials and equipment, or securing in place, would be performed to the extent possible, relocating outside the 500-year floodplain.

Wetlands

No wetlands are located within the Project site and, therefore, no wetlands would be directly impacted during decommissioning. Measures anticipated to be implemented under an approved SWPPP to protect against stormwater contamination (by vehicles, leaks, spills, refueling, etc.) and discharges including soil and sediment, would also minimize the potential for any water quality impacts to the adjacent offsite wetlands during decommissioning. Therefore, impacts to wetlands from proposed Facility decommissioning would be negligible.

3.3.3.2 Rail Corridor

Impacts of rail transportation to water resources in the rail corridor study area could result from brakepad consumption, locomotive lubrication, and fuel drips due to increased rail operations in general (Puget Sound Regional Council 2010). Drips and leaks of very small quantities of crude oil and diesel would create a sheen on surface water immediately adjacent to the rail line, including potentially surface waters immediately adjacent to the rail line. However, the Project-specific contribution to these chronic, low-level sources of water quality impairment from rail transportation use would be minor. Rail transportation operations would not be anticipated to have adverse impacts to surface water intakes or wellheads used for drinking water, agriculture, or industrial uses. Rail operations associated with the proposed Facility would not add any new flood hazard risks to rail bridges, and rail operations would not require construction within floodplains or the placement of permanent fill that could modify floodwater elevations or routing, resulting in negligible impacts to floodplains.

3.3.3.3 Vessel Corridor

Wakes and wave action generated by deep-draft vessels associated with the proposed Facility could impact water quality of the Lower Columbia River by direct turbulence, erosion, sedimentation, and sediment resuspension. Areas vulnerable to bank erosion would include those reaches with actively migrating channel margins and some of the more confined valley sections, which are not extensive. Resuspension of sediments would result in turbidity within the water column that would dissipate at various rates and distances depending on several factors, including river depth and discharge, tidal currents, horizontal and vertical velocities, salinity (i.e., water density), and bed sediment particle sizes (Pearson and Skalski 2011, Liedermann et al. 2014). Redeposition of fine sediments would occur within lower-velocity areas of the channel and active bars and floodplain areas with low bank heights and angles (e.g., bars and low floodplain surfaces). Such temporary increases in turbidity and local redistribution of sediment on the channel bed and/or to active channel bars and floodplain surfaces from vessel transits within the Lower Columbia River would not be considerably different from natural geomorphic processes, nor would it be expected to alter the river channel, its hydrology, or water quality relative to baseline conditions, and it would therefore be considered negligible.

Wakes from deep-draft vessels also have the potential to impact wetland vegetation communities directly (i.e., breakage, uproot) or indirectly through altered sediment patterns and erosion. The potential for negative effects to wetlands would be limited to the lower approximately 33 miles of the river where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent. Wake effects would be the greatest as vessels pass through the Columbia River Estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The increase in deep-draft vessel traffic and associated increase in vessel wakes could have a minor to moderate impact to wetland vegetation, primarily in the Columbia River Estuary.

Sediments contaminated with PAHs, PCBs, and PBDEs exist along the Lower Columbia River, and vessel traffic remobilization of bed materials may transport and redistribute existing contaminants or temporarily affect localized dissolved oxygen levels. The location, severity, and duration of impacts from remobilization of existing legacy contaminants is difficult to predict but would not be substantially different from impacts from existing and historical vessel movements. However, resuspension of existing contaminants would likely violate water quality standards, at least locally and temporarily, which would not be readily anticipated, prevented, or otherwise mitigated. Therefore, while the incremental impact from vessels associated with the proposed Facility would likely be minor, potential water quality consequences of resuspended contaminants could be moderate.

Potential impacts from the discharge of ballast water include an increase in total dissolved solids, mostly from salinity, and an increase in pH, as seawater has a higher pH (7.5 to 8.4) than fresh water (6.5 to 7.5); however, these pH levels are within Washington's water quality standard. Impacts from the discharge of ballast water would depend on the location of the discharge and the size and areal extent of the ballast water dispersion. Since vessels calling at the proposed Facility marine terminal would either perform an open-water exchange before entering Washington waters or carry only ballast treated to water quality standards, only negligible impacts would be anticipated.

No impacts to water resources would occur in waters beyond the 3-nmi boundary near the mouth of the Columbia River (impacts from oil spills, fires, and explosions are discussed in Chapter 4).

3.3.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to water resources from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to water resources beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Impacts from construction, operations and maintenance, and decommissioning of another facility at the site would depend on the type of facility constructed; however, these effects are anticipated to be similar to those identified for the proposed Facility and may include sediment entering the Columbia River from upland areas during construction, potentially affecting surface water quality; release of existing contaminants in areas with environmental covenants, potentially affecting groundwater quality; and insufficient treatment capability of onsite stormwater systems, resulting in untreated stormwater entering the Columbia River.

3.3.5 Mitigation Measures

The design features and BMPs the Applicant proposes to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to water resources in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce impacts to water resources:

- Install and maintain an erosion/sediment control barrier along the top of the Columbia River embankment for the areas adjacent to stone column installations consisting of silt fencing, filtration fabric, and straw wattles or similar measures approved by EFSEC. Monitor the water on the river side of the sediment control barrier to ensure the expected level of water quality is maintained. If the water quality on the river side of the barrier is unacceptable, implement additional sediment control measures until the desired level is achieved. These measures would reduce impacts to minor levels.
- Conduct groundwater water quality monitoring for pH and sulfate content during jet-grouting activities between the columns and the temporary sheet pile wall, in a geographic pattern and at appropriate depths, to determine the magnitude of any elevated levels and the potential for such contaminants to reach surface water under the sheet pile wall. In the event that monitoring revealed excessive pH or sulfate content, install additional sheet pile barriers to prevent contaminated water from entering the Columbia River, or halt jet grouting until a modified approach with BMPs can be approved by EFSEC. These measures would reduce impacts to minor levels.
- Install surface water monitoring wells downslope from the stone column and jet grout column installation areas to monitor water quality during the installation of these improvements. In the event of unacceptably high pH levels and/or sulfate levels in monitored water, install additional sheet pile barriers to prevent contaminated water from entering the Columbia River. Additional impacts associated with this mitigation would include more disturbance of existing site soils and some additional construction activity. These additional impacts would be negligible to minor and would reduce pH levels and/or sulfate to levels to be minor.
- Monitor flood predictions, warnings, and the rate of floodwater rise, and in the event of a flood event, temporarily suspend operations at threatened proposed Facility elements prior to the flooding. In the event of an expected site inundation, demobilize movable equipment such as railcars and motor vehicles and relocate above the 500-year floodplain to the extent possible. Secure static equipment that cannot be moved.

- Install permanent measures to cap and/or seal areas with subsurface ground improvement columns during decommissioning to prevent surface water from infiltrating and conveying contaminants into areas where vertical columns could facilitate groundwater movement and migration of contaminants. Contain hydrocarbon residuals in existing pipelines during removal.
- Obtain copies of all well abandonment forms listed in Ecology's well-log database for high-producing wells installed between 1940 and 1967 and associated with the former Alcoa facility to verify that the wells were abandoned during site remediation.

In addition, EFSEC may include additional water quality mitigation measures during water quality permitting.

3.3.6 Significant Unavoidable Adverse Impacts

The increase in deep-draft vessel traffic and associated increase in vessel wakes could have a minor to moderate impact to wetland vegetation, primarily in the Columbia River Estuary.

While the incremental impact from vessels associated with the proposed Facility would likely be minor, vessel induced resuspension of existing (legacy) contaminated bed sediments in the Lower Columbia River could cause moderate local effects that could violate water quality standards and beneficial uses; the location, timing, or duration of impact cannot be readily predicted.

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3.4 TERRESTRIAL VEGETATION

This section describes the existing vegetation resources at and near the proposed Facility at the Port and along the proposed rail and vessel transportation routes. Descriptions of the affected environments are scaled to the areas that would likely experience direct and/or indirect effects from Project construction, operation and maintenance, and decommissioning. The description of the affected environment includes areas that could be affected by a spill, fire, or explosion, as discussed in Chapter 4. Descriptions of potential impacts to threatened, endangered, or sensitive vegetation are provided. The Applicant has completed a separate Biological Evaluation (BE), which evaluated two endangered and one threatened plant potentially affected by the Project that are protected under the federal Endangered Species Act (ESA) (BergerABAM 2014a). Information from the BE has been incorporated into this section.

3.4.1 Methods of Analysis

The study areas used to describe the affected environment and to assess impacts to terrestrial vegetation include:

- **The proposed Facility study area**—located at the Port, including the northwestern corner of Terminal 5, storage area (Area 300), Berths 13 and 14 in Terminal 4, and transfer pipeline areas that connect these three areas. This study area also includes areas within 1 mile of the proposed Facility because vegetation within this distance could be affected by an oil spill or fire.
- **The rail corridor study area**—includes the rail route from Williston, North Dakota, through Spokane and Pasco, to the Port, including a 0.5-mile corridor along each side of the rail track.
- **The rail-Columbia River study area**—includes the corridor that extends 216 river miles along the Columbia River between Kennewick and the Port, including an area extending 1 mile downstream from the Port (Figure 3.0-2). This study area is used to address potential crude oil spills, fires, and explosions in Chapter 4. The rail-Columbia River corridor covers all contiguous side/off-channels, sloughs and associated wetlands, and adjacent riparian and upland habitats within 0.25 mile of the river shoreline. The rail corridor study area and rail-Columbia River corridor study area overlap and extend into Oregon.
- **The vessel corridor study area**—includes vessel routes between the Port and the Pacific Ocean; this extends 106 river miles along the Columbia River and includes all contiguous side/off-channels, sloughs and associated wetlands, and adjacent riparian and upland habitats within 0.25 mile of the river shoreline. The vessel corridor extends offshore to the 3-nmi limit.

Information on the affected environment for terrestrial vegetation was developed based on identification of existing vegetation communities within the study areas described above. Impacts to vegetation were assessed by identifying the likely extent of impacts occurring from Facility construction, operation and maintenance, and decommissioning, including vegetation removal, dust accumulation on vegetation, stormwater runoff, small leaks of hazardous materials, and introduction of noxious weeds. The assessment also considers potential impacts from associated train and vessel operations, including leaks and spills from railcars or vessels, increased concentrations of hydrocarbons, transfer of exotic species or noxious weeds, and disturbance of riparian vegetation.

The analysis of impacts to terrestrial vegetation was based in part on information provided by the Applicant, including the Applicant-prepared Preliminary Draft EIS (BergerABAM 2014b) and findings from the BE prepared for the USACE as part of the Section 10 and Section 404 permit review process (Berger ABAM 2014a). This information was supplemented with additional data collection and review by

EFSEC's consultant. More specifically, the analyses presented in this section were based on the following data sources:

- Applicant-mapped and described vegetation communities at the proposed Facility; note that the aerial photography shown on various figures in this section predates the current vegetation mapping (BergerABAM 2014b).
- The USGS Gap Analysis Program (GAP) Land Cover Data Set for vegetation communities in Washington, Idaho, Montana, and North Dakota (USGS 2011).
- The Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) Program maps and online interactive mapping database for review and updating of habitat and vegetation information in Washington, provided by the Applicant (WDFW 2008, 2014).
- The WDFW PHS Program maps and online interactive mapping database for review and update of special-status wildlife occurrence within the proposed Facility, rail corridor, and vessel corridor study areas in Washington; the presence of suitable habitat was used to evaluate whether and when special-status species were likely to be present (WDFW 2008, 2014, 2015).
- The Washington Natural Heritage Program (WNHP) database for review and update of special-status plant occurrence within the proposed Facility study area in Washington (WNHP 2012).
- The US Fish and Wildlife Service (USFWS) website for review and update of special-status plant occurrence within the respective study areas (USFWS 2015).
- State species of concern were identified for the rail corridor study area based on the US Forest Service (USFS) and Bureau of Land Management (BLM) Interagency Special-Status/Sensitive Species Program (USFS and BLM 2011), the Idaho Comprehensive Wildlife Strategy (Idaho Department of Fish and Game 2005), the Montana Natural Heritage Program (MNHP 2014), and the Oregon Department of Fish and Wildlife (ODFW) Sensitive Species List (ODFW 2008).

Special-status plants include plants that are federally listed under the ESA as threatened, endangered, proposed, and candidates; USFWS species of concern; USFS and BLM sensitive plants; and state-listed threatened, endangered, and sensitive plants. Discussions of special-status species are included in the discussions of terrestrial vegetation.

3.4.2 Affected Environment

3.4.2.1 Proposed Facility

Vegetation Communities

Limited native vegetation is present at the proposed Facility site. Existing land cover is predominately unvegetated industrial land. Most of the Facility site has been previously filled, paved, and/or capped in association with development and cleanup activities.

The native vegetation that does persist at the Facility site is of limited quality and quantity and comprises three terrestrial vegetation communities (Figure 3.4-1):

- Ruderal[1] upland grass/forb

1 The ruderal community type is defined as weedy vegetation growing on compacted, plowed, or otherwise disturbed ground and showing a preference for this type of habitat (Biology Online 2005).

- Riparian
- Upland cottonwood stands

No special-status plants protected under federal and/or state laws have been identified at or within 1 mile of the proposed Facility site (WHNP 2014). The nearest documented occurrence of a special-status plant is two occurrences of the state sensitive western ladies tresses (*Spiranthes porrifolia*) located more than 1 mile northwest of the proposed Facility site (WHNP 2014). The unvegetated industrial land cover type and the three terrestrial vegetation communities present on the Facility site are described further below.

Unvegetated Industrial

The unvegetated industrial land cover at the proposed Facility site consists of areas with industrial infrastructure such as buildings, rail lines, roads, and other paved and graveled surfaces. These areas are generally devoid of vegetation and include graveled areas, impervious surfaces, and little to no surface soil. Scattered individual plants or small patches of vegetation (typically weedy plants and sparse grasses) may be present. Unvegetated industrial areas do not provide quality habitat for other species. Approximately 116 acres of unvegetated industrial land cover is present at the proposed Facility site (Figure 3.4-1).

Ruderal Upland Grass/Forb

Upland vegetation in the ruderal upland grass/forb community occurs as small patches of grasses and a mix of native and nonnative weedy herbaceous plants, including colonial bentgrass (*Agrostis capillaris*), rabbitfoot clover (*Trifolium arvense*), white sweet clover (*Melilotus alba*), and Canada thistle (*Cirsium arvense*). Ruderal plants are the first to colonize disturbed lands and are often the dominant species in the disturbed area for several years until competing species can become established. Ruderal plants increase soil stability of recently disturbed areas and some species have attractive flowers, which improve the aesthetic of such areas. About 5 acres of ruderal upland grass/forb vegetation occurs on the proposed Facility site, primarily in the areas that would be crossed by transfer pipelines (Figure 3.4-1).

Riparian

Little riparian vegetation is present at the proposed Facility site because the riverbank drops steeply near the marine terminal and has been hardened to prevent erosion. Riparian vegetation generally includes black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and willows (*Salix* spp.), nonnative false indigo bush (*Amorpha fruticosa*), and Himalayan blackberry (*Rubus armeniacus*). Scattered nonnative grasses are also present. Riparian vegetation is essential for bank stabilization, flood control, and water quality protection. It is also an important factor in maintaining the food chain and providing thermal cover and habitat for fish and other aquatic species. About 1.6 acres of riparian communities have been identified along the Columbia River bank at the marine terminal and along the eastern side of the storage area (Figure 3.4-1).

Upland Cottonwood Stands

Several small stands of black cottonwood are present at the proposed Facility site in the area that would be crossed by transfer pipelines. These stands are dominated by a closed canopy of black cottonwood with a few Oregon ash (*Fraxinus latifolia*) and limited understory vegetation. Cottonwood stands act as windbreaks and provide habitat for nesting birds and other wildlife. These stands are isolated from adjacent stands of trees by unvegetated industrial land cover. About 3.1 acres of upland cottonwood stands have been identified at the proposed Facility site (Figure 3.4-1).

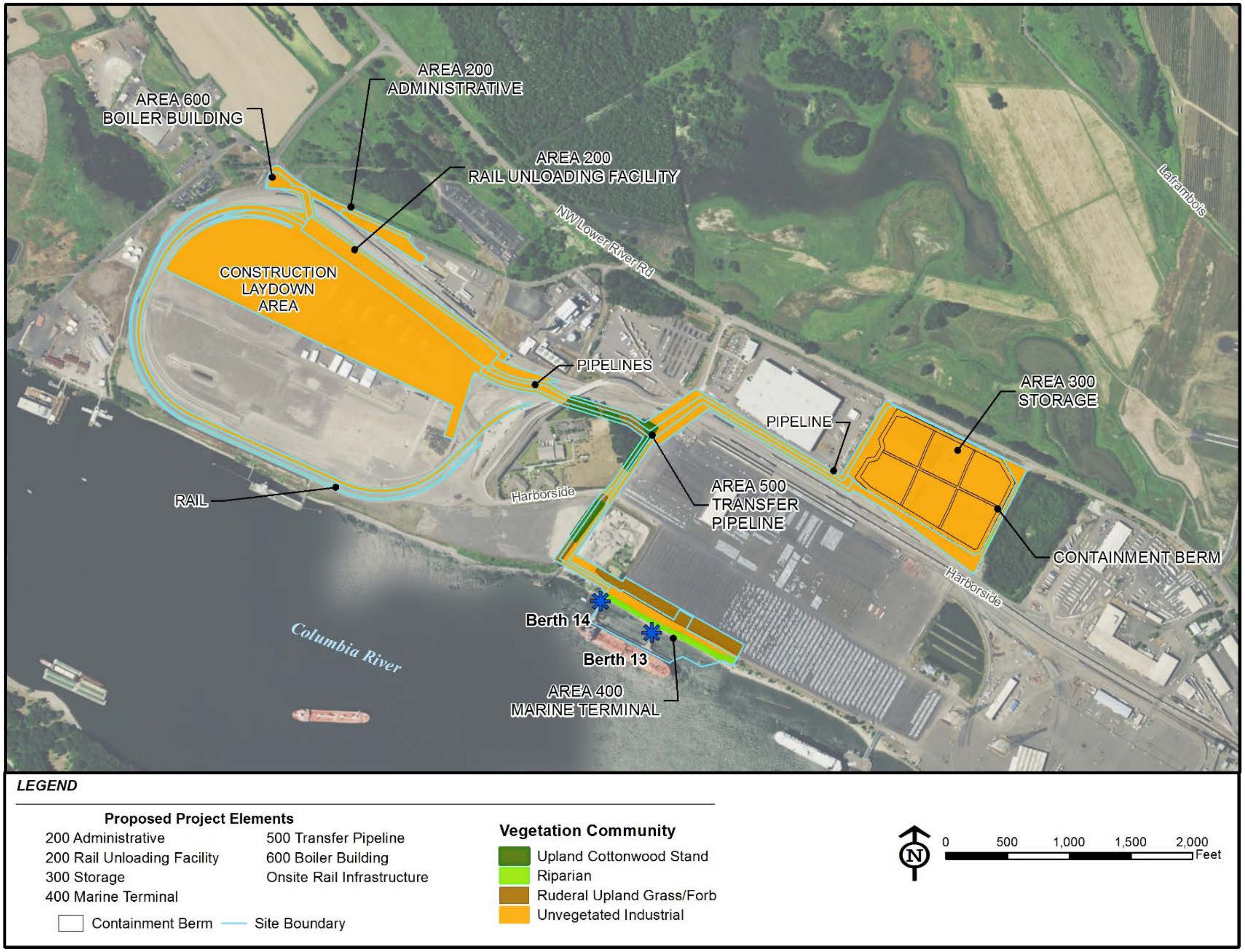

Figure 3.4-1. Vegetation Communities at the Proposed Facility Site

Noxious Weeds

Noxious weeds are nonnative plants that have been designated as undesirable under federal and state laws. The Washington Department of Agriculture is responsible for listing noxious weeds within the state. The Washington Noxious Weed Control Board maintains the official list and provides updates as warranted. Noxious weeds and invasive plants generally displace native plants; decrease vegetation community diversity; degrade wildlife habitats; decrease productivity of farms, rangelands, and forests; diminish aesthetics; and impair the usefulness of the landscape for both wildlife and humans. As an example, Scotch broom (*Cytisus scoparius*), a Class B noxious weed known to occur in Clark County, crowds out native plants by spreading aggressively to form dense stands that prevent forest regeneration and impede wildlife and livestock movements (King County 2008). Its seeds are toxic to livestock and dense stands are considered a potential fire hazard (King County 2008).

Washington has three classes of noxious weeds:

- Class A–designated weeds are relatively new to the state and in small enough infestations to make eradication possible. Under current law, landowners are responsible for eradicating Class A weeds.
- Class B–designated weeds are widespread across portions of the state, but are rare or absent in others. The goal is to prevent Class B weeds from expanding into new areas and reduce existing infestations. Recommended control actions are limited to intensive control at the state, county, or regional level as determined on a site-specific, case-by-case basis.
- Class C weeds are common and widespread across the state. The goal is to control existing infestations to the extent possible as required by local agencies.

Several noxious weeds present at the proposed Facility are typical of developed industrial sites, including two Class C weeds—Canada thistle and Himalayan blackberry—and one Class B weed—indigo bush. Additional noxious weeds may be present at the proposed Facility site; however, specific weed inventories of the site have not been completed. Eight Class A, 29 Class B, and 20 Class C noxious weeds are known to occur in Clark County and could also be present at the proposed Facility site (Clark County 2013, BergerABAM 2014b).

3.4.2.2 Rail Corridor

Land Cover and Vegetation Communities in Washington

The rail corridor within Washington crosses or parallels freshwater rivers and streams and long stretches of the Columbia River (approximately 216 river miles) such that the predominant land cover along the rail corridor (24 percent) is open water (Table 3.4-1). Areas developed for human use and areas with agricultural vegetation represent 32 percent of the area along the rail corridor. The 1-mile-wide rail corridor extends into Oregon (5 percent) and Idaho (less than 1 percent; Table 3.4-1). Native vegetation crossed by the rail corridor includes more than 60 different vegetation communities primarily within the semidesert (22 percent), forests and woodlands (8 percent), and shrubland and grassland (3 percent) vegetation types (Table 3.4-1; Appendix H).

Semidesert communities are predominately big sagebrush (*Artemisia tridentata*) steppe and shrubland communities (Appendix H). Forest and woodland vegetation communities within the rail corridor are predominately ponderosa pine (*Pinus ponderosa* var. *ponderosa*) woodland and savanna, and maritime dry-mesic-wet Douglas fir (*Pseudotsuga menziesii*)-western hemlock (*Tsuga heterophylla*) forests. Shrublands and grasslands are predominately Columbia Basin dry grasslands (Appendix H) with deep-rooted bunchgrass such as bluebunch wheatgrass (*Pseudoroegneria spicata*) or Fendler threeawn (*Aristida purpurea* var. *longiseta*) (WDNR 2011a) and Northern Rocky Mountain grasslands with cool-season bunchgrasses such as bluebunch wheatgrass, rough fescue (*Festuca campestris*), Idaho fescue (*Festuca idahoensis*), or prairie Junegrass (*Koeleria macrantha*) (WDNR 2011b).

The rail-Columbia River study area overlaps with the rail corridor study area and shares many land cover types, but unlike the rail corridor, the rail-Columbia River study area contains a larger proportion of open water (62 percent) and smaller proportions of agricultural or developed lands (14 percent), semidesert (11 percent), and shrubland and grassland habitats (1 percent). Forests and woodlands habitats are of relatively similar proportions in the rail (8 percent) and rail-Columbia River (7 percent) corridors (Table 3.4-1).

Table 3.4-1. Land Cover and Vegetation Types within Washington

Land Cover/Vegetation Type	Rail Corridor		Rail-Columbia River Corridor		Vessel Corridor	
	Acreage[a]	% Area	Acreage[b]	% Area	Acreage[c]	% Area
Agricultural Vegetation	45,110.3	18%	9,846.9	5%	14,358.8	8%
Aquatic Vegetation	--	--	--	--	4.8	0%
Developed and Other Human Use	33,251.1	13%	17,959.6	9%	5,238.0	3%
Forest and Woodland	21,031.5	8%	13,565.2	7%	23,257.9	13%
Introduced and Seminatural Vegetation	19,773.5	8%	7,321.6	4%	--	--
Nonvascular and Sparse Vascular Rock Vegetation	3,599.4	1%	3,260.9	2%	1.6	0%
Open Water	58,980.4	24%	128,252.4	62%	108,019.0	59%
Polar and High Montane Vegetation	2.0	0%	--	--	--	--
Recently Disturbed or Modified	2,448.7	1%	864.7	0%	2,217.0	1%
Semidesert	55,366.6	22%	23,737.9	11%	--	--
Shrubland and Grassland	8,481.7	3%	2,833.1	1%	28,766.9	16%
Total	248,045.0	100%	207,642.2	100%	181,864.0	100%

Source: USGS (2011)

a Calculated within 0.5 mile on both sides of the railway along the in-state portion of the delivery route (95% Washington, 5% Oregon, <1% Idaho); overlaps with rail-Columbia River corridor, Oregon and Idaho.

b Calculated within 0.25 mile of both sides of the Columbia River shoreline in Washington (55%) and Oregon (45%).

c Calculated within 0.25 mile of both sides of the Columbia River shoreline in Washington (36%) and Oregon (64%).

-- Indicates the land cover or vegetation type does not occur within the corridor.

Semidesert communities within the rail-Columbia River corridor are predominately big sagebrush steppe and shrubland communities. Forest and woodland vegetation communities within the rail-Columbia River corridor are predominately lowland mixed hardwood-conifer forests and woodland generally with codominant red alder (*Alnus rubra*) or bigleaf maple (*Acer macrophyllum*) with Douglas fir and/or western hemlock and maritime dry-mesic-wet Douglas fir-western hemlock forests (Appendix H; WDNR 2011c). Shrublands and grasslands are predominately emergent marshes and wetlands with bulrushes (*Scirpus* spp.), sedges (*Carex* spp.), and narrowleaf cattails (*Typha latifolia*) (WDNR 2011d), or Columbia Basin dry grasslands with bunchgrasses such as bluebunch wheatgrass or Fendler threeawn (WDNR 2011e).

Special-Status Plants

Within Washington, special-status plants include plants that are federally listed under the ESA as threatened, endangered, proposed, and candidates; USFWS species of concern; USFS and BLM sensitive plants; and state-listed threatened, endangered, and sensitive plants. A list of special-status plants known to occur within the Washington portion of the rail, rail-Columbia River, and vessel corridor study areas based on current WNHP data (1977 to 2014) is provided in Table 3.4-2 (WNHP 2014).

A total of 79 occurrences of 37 special-status plants have been documented within the rail corridor in Washington. These species include the federal threatened Spalding's silene (*Silene spaldingii*) and water howellia (*Howellia aquatilis*) and the federal candidate Wormskioldii's northern wormwood (*Artemisia campestris* var. *wormskioldii*). Thirty-two of the 37 special-status plant species are listed as USFS and BLM Special-Status Species–Sensitive (Table 3.4-2). State-listed plants reported within the rail corridor include 5 occurrences of 5 endangered plants, 32 occurrences of 15 threatened plants, and 42 occurrences of 17 sensitive plants (Table 3.4-2). Many of these same sensitive plants also occur in the rail-Columbia River study area, although neither of the federal threatened plants occurs within the rail-Columbia River corridor. State-listed plants reported within the rail-Columbia River corridor include 4 occurrences of 4 endangered plants, 18 occurrences of 8 threatened plants, and 32 occurrences of 14 sensitive plants (Table 3.4-2).

Noxious Weeds

Currently, 142 plants are included on Washington's noxious weed list and are categorized as either Class A, B, or C according to their presence and distribution within the state (Washington Department of Agriculture 2014, BergerABAM 2014b). It is likely that some or all of these weeds are present within or in close proximity to the rail corridor study area.

Land Cover and Vegetation Communities in Idaho, Montana, and North Dakota

Most of the rail corridor outside of Washington would cross through Montana (85 percent), followed by Idaho (12 percent) and then North Dakota (3 percent) (Table 3.4-3). Most of the route through Idaho crosses forests and woodlands (52 percent), which are predominately northern Rocky Mountain dry-mesic/mesic montane mixed conifer forests (75 percent) with Douglas fir, western larch (*Larix occidentalis*), grand fir (*Abies grandis*), ponderosa pine, and lodgepole pine (*Pinus contorta*); and ponderosa pine woodland and savanna (21 percent) (Appendix H). Much of the route through Montana crosses agricultural or developed lands (44 percent), followed by forested lands (26 percent) and shrublands and grasslands (17 percent) (Table 3.4-3).

Forests and woodlands along the rail corridor in Montana are also predominately northern Rocky Mountain dry-mesic/mesic montane mixed conifer forests (52 percent), but riparian forests (20 percent) including lower montane riparian woodland and shrubland and northwestern Great Plains floodplain and riparian forest with black cottonwood, boxelder maple (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), and plains cottonwood (*Populus deltoides*) make up a larger proportion of forested habitats.

Much of the route through North Dakota crosses agricultural or developed lands (43 percent), followed by shrublands and grasslands (35 percent) and forested lands (14 percent) (Table 3.4-3). Shrublands and grasslands in North Dakota (95 percent) and Montana (47 percent) are predominately mixed grass prairie usually dominated by western wheatgrass (*Pascopyrum smithii*) (Appendix H). Forested lands in North Dakota are primarily floodplain and wooded draws and ravines with cottonwoods (Appendix H).

Table 3.4-2. Special-Status Plant Occurrence within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Common Name	Scientific Name	Federal	State	Number of Occurrences within Corridors[a]		
		ESA / SSS Status[b]	Listing Status[c]	Rail	Rail-Columbia River	Vessel
American pillwort	*Pilularia americana*	None / SEN	ST	1	0	0
Barrett's beardtongue	*Penstemon barrettiae*	FSC / SEN	ST	4	4	0
Bog clubmoss	*Lycopodiella inundata*	None / SEN	SS	1	0	0
California broomrape	*Orobanche californica* ssp. *grayana*	None	SE	1	0	0
Common bluecup	*Githopsis specularioides*	None	SS	3	3	0
Coyotebush	*Baccharis pilularis* ssp. *consanguinea*	None	ST	0	0	1
Diffuse stickseed	*Hackelia diffusa* var. *diffusa*	None / WA-SEN	ST	1	1	0
Few-flowered collinsia	*Collinsia sparsiflora* var. *bruceae*	None / WA-SEN	SS	3	3	0
Fuzzytongue penstemon	*Penstemon eriantherus* var. *whitedii*	None / WA-SEN	SS	1	1	0
Gooseberry-leaved alumroot	*Heuchera grossulariifolia* var. *tenuifolia*	None	SS	2	2	0
Gorge daisy	*Erigeron oreganus*	FSC / SEN	ST	3	2	2
Gray cryptantha	*Cryptantha leucophaea*	FSC / WA-SEN	SS	0	1	0
Hairy-stemmed checker-mallow	*Sidalcea hirtipes*	None / SEN	ST	0	0	1
Inch-high rush	*Juncus uncialis*	None / WA-SEN	SS	2	1	0
Marigold navarretia	*Navarretia tagetina*	None / WA-SEN	ST	1	1	0
Mousetail	*Myosurus clavicaulis*	None / WA-SEN	SS	3	1	0
Nuttall's quillwort	*Isoetes nuttallii*	None / WA-SEN	SS	2	2	0
Ocean-bluff bluegrass	*Poa unilateralis* ssp. *pachypholis*	None / WA-SEN	ST	0	0	1
Oregon bolandra	*Bolandra oregana*	None / WA-SEN	SS	6	5	0
Oregon coyote-thistle	*Eryngium petiolatum*	None / WA-SEN	ST	1	1	0
Oregon sullivantia	*Sullivantia oregana*	FSC / SEN	SE	1	1	0
Pale blue-eyed grass	*Sisyrinchium sarmentosum*	FSC / SEN	ST	1	0	0
Pauper milk-vetch	*Astragalus misellus* var. *pauper*	None / WA-SEN	SS	1	0	0
Persistentsepal yellowcress	*Rorippa columbiae*	FSC / SEN	ST	1	1	0

Table 3.4-2. Special-Status Plant Occurrence within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Common Name	Scientific Name	Federal	State	Number of Occurrences within Corridors[a]		
		ESA / SSS Status[b]	Listing Status[c]	Rail	Rail-Columbia River	Vessel
Piper's daisy	*Erigeron piperianus*	None / WA-SEN	SS	2	0	0
Silverskin lichen	*Dermatocarpon meiophyllizum*	None	ST	1	0	0
Small-flowered trillium	*Trillium parviflorum*	None / WA-SEN	SS	2	0	0
Smooth desert-parsley	*Lomatium laevigatum*	None / WA-SEN	ST	8	7	0
Smooth goldfields	*Lasthenia glaberrima*	None / WA-SEN	SE	1	1	0
Snake River cryptantha	*Cryptantha spiculifera*	None / WA-SEN	SS	1	1	0
Soft-leaved willow	*Salix sessilifolia*	None / WA-SEN	SS	0	0	3
Spalding's silene	*Silene spaldingii*	FT	ST	2	0	0
Suksdorf's desert-parsley	*Lomatium suksdorfii*	FSC / SEN	SS	1	1	0
Tall bugbane	*Cimicifuga elata*	FSC	SS	5	4	0
Tufted evening-primrose	*Oenothera cespitosa* ssp. *marginata*	None / WA-SEN	ST	1	1	0
Washington polemonium	*Polemonium pectinatum*	FSC / WA-SEN	ST	1	0	0
Water howellia	*Howellia aquatilis*	FT	ST	5	0	0
Water pimpernel	*Samolus parviflorus*	None	SS	0	0	2
Western ladies' tresses	*Spiranthes porrifolia*	None / WA-SEN	SS	6	6	1
Western wahoo	*Euonymus occidentalis* var. *occidentalis*	None	SS	1	1	0
Wheeler's bluegrass	*Poa nervosa*	None	SS	0	0	2
White meconella	*Meconella oregana*	FSC / SEN	SE	1	1	0
Wormskioldii's northern wormwood	*Artemisia campestris* var. *wormskioldii*	FC / SEN	SE	1	1	0
Yellow lady's-slipper	*Cypripedium parviflorum*	None	ST	1	0	0

Sources: WNHP (2014), USFS and BLM (2011)

a The 1-mile rail and rail-Columbia River study area corridors overlap; occurrences are repeated within each corridor where they overlap.

b ESA Classifications: FE = federal endangered; FT = federal threatened; FC = federal candidate; FSC = federal species of concern; None = no federal ESA status
USFS and BLM Special-Status Species (SSS) Categories: SEN = Sensitive in Oregon or Washington; OR-SEN = Sensitive in Oregon only; WA-SEN = Sensitive in Washington only.

c State Status: SE = state endangered; ST = state threatened; SS = state sensitive.

Table 3.4-3. Land Cover and Vegetation Types along the Rail Corridor in Idaho, Montana, and North Dakota

Land Cover/Vegetation Types	Idaho		Montana		North Dakota		Total
	Acreage	% Area	Acreage	% Area	Acreage	% Area	
Agricultural Vegetation	4,652.1	7%	150,018.9	35%	4,592.3	31%	159,263.2
Developed and Other Human Use	7,692.7	12%	39,670.5	9%	1,737.6	12%	49,100.8
Forest and Woodland	32,470.8	52%	111,282.0	26%	2,129.9	14%	145,882.6
Introduced and Seminatural Vegetation	0	0%	31,740.6	7%	42.3	0%	31,782.9
Nonvascular and Sparse Vascular Rock Vegetation	6.7	0%	3,058.4	1%	0	0%	3,065.0
Open Water	3,717.2	6%	9,097.1	2%	979.5	7%	13,793.8
Recently Disturbed or Modified	399.4	1%	4,368.8	1%	200.3	1%	4,968.5
Semidesert	0	0%	10,133.9	2%	10.5	0%	10,144.3
Shrubland and Grassland	13,761.0	22%	72,074.4	17%	5,212.2	35%	91,047.6
Total	62,699.9	100%	431,444.5	100%	14,904.4	100%	509,048.7

Source: USGS (2011)

Note: Analysis based on a 0.5-mile-wide buffer (1-mile total width) of the rail route.

Special-Status Plants

Five federally listed threatened plants and one candidate for listing may occur within or near the rail corridor study area outside of Washington (Table 3.4-4). The BLM and USFS sensitive species listings include numerous vascular and nonvascular plants, lichens, and fungi that could occur within the rail corridor. These sensitive plants, lichens, and fungi would be protected on BLM and USFS lands.

Table 3.4-4. Federally Listed Plants Potentially Occurring within the Rail Corridor in Idaho, Montana, and North Dakota

Common Name	Scientific Name	Status	Idaho	Montana	North Dakota
Macfarlane's four-o'clock	*Mirabilis macfarlanei*	FT	X	--	--
Spalding's catchfly	*Silene spaldingii*	FT	X	X	--
Ute ladies'-tresses	*Spiranthes diluvialis*	FT	X	X	--
Water howellia	*Howellia aquatilis*	FT		X	--
Western prairie fringed orchid	*Platanthera praeclara*	FT	--	--	X
Whitebark pine	*Pinus albicaulis*	FC	X	X	--

Source: USFWS (2014)

Notes:

Status: FT = federal threatened, FC = federal candidate

X denotes presence within the state, -- denotes nonoccurrence within the state

Noxious Weeds

Idaho, Montana, and North Dakota maintain lists of noxious weeds that are regularly updated by each state's Department of Agriculture. Each state has a noxious weed law and county weed boards that work with state and federal land managers to implement weed management programs. Table 3.4-5 summarizes each state's approach to designating noxious weeds.

Table 3.4-5. Noxious Weeds Listing Approach in Idaho, Montana, and North Dakota

State	Number of Noxious Weeds	Listing Approach
Idaho	67	Idaho uses 3 designations: Early Detection Rapid Response (EDRR), Statewide Control, and Statewide Containment.
Montana	32	Montana uses 5 categories to designate priorities; 1A, 1B, 2A, 2B, and 3.
North Dakota	11	North Dakota lists 11 noxious weeds that are enforced by cities and counties and 1 watch weed.

Sources: Idaho State Department of Agriculture (2015), Montana Department of Agriculture (2014), North Dakota Department of Agriculture (2015)

3.4.2.3 Vessel Corridor

Vegetation Communities

The vessel corridor extends along the lower Columbia River between the Port and the Columbia River mouth and out to the 3-nmi boundary, passing adjacent vegetation communities within 0.25 mile from the shoreline. Aquatic vegetation communities are distributed throughout the vessel corridor and range from freshwater riverine wetland communities to submerged aquatic marine vegetation (Appendix H). Washington and Oregon share their border at the Columbia River; the vessel corridor, although primarily open water (59 percent), is disproportionately split between Washington (36 percent) and Oregon (64 percent) (see Table 3.4-1).

Shrublands and grasslands (16 percent) are the most abundant land cover followed by forests and woodlands (13 percent), and then agricultural and developed (11 percent; see Table 3.4-1). Within the shrublands and grasslands, the most common vegetation communities are intertidal freshwater wetlands, coastal sand dune and strand, and freshwater mudflats. Vegetation structure varies in the intertidal freshwater wetlands depending on substrate characteristics, elevation, and tidal flooding and includes tree, shrub, and herbaceous patches (WDNR 2011e). Herbaceous plants are commonly sedges (Lyngbye's sedge [*Carex lyngbyei*], slough sedge [*Carex obnupta*]), western watermilfoil (*Myriophyllum hippuroides*), narrowleaf cattail (*Typha angustifolia*), and common ladyfern (*Athyrium filix-femina*) (WDNR 2011e).

Coastal dunes and strand vegetation typically includes herbaceous plants, succulents, shrubs, and trees with varying degrees of tolerance for salt spray, wind and sand abrasion, and substrate stability. These dunes can be dominated by sand ryegrass (*Leymus arenarius*), red fescue (*Festuca rubra*), American dunegrass (*Leymus mollis*), or various forbs adapted to salty, dry conditions (WDNR 2011f). The beachgrasses (European beachgrass [*Ammophila arenaria*] and American beachgrass [*Ammophila breviligulata*]) are exotic grasses that were planted to stabilize dunes, that have effectively changed the nature of Pacific Northwest coastal dune habitats from open and sparsely vegetated mobile systems to large, continuous, and stable systems subject to forestation.

Special-Status Plants

A total of 13 occurrences of 8 special-status plants including the federal sensitive gorge daisy (*Erigeron oreganus*) have been documented within the vessel corridor study area (see Table 3.4-2). Five of the

32 USFS and BLM Special-Status Species–Sensitive plants occur in the vessel corridor. State-listed plants reported within the vessel corridor include five occurrences of four threatened plants and eight occurrences of four sensitive plants (Table 3.4-2).

Noxious Weeds

Invasive weeds, such as the aquatic invasive reed canarygrass (*Phalaris arundinacea*), giant knotweed (*Polygonum sachalinense*), and Himalayan blackberry are problematic in North Pacific intertidal freshwater wetlands (WDNR 2011d). Invasive exotic freshwater plants in Washington include Brazilian elodea (*Egeria densa*), Eurasian watermilfoid (*Myriophyllum spicatum*), fanwort (*Cabomba carolinia*), fragrant water lily (*Nymphaea odorata*), hydrilla (*Hydrilla verticillata*), parrotfeather (*Myriophyllum aquaticum*), greater bladderwort (*Utricularia inflate*), water hyacinth (*Eichhornia crassipes*), water primrose (*Ludwigia hexaptala*), and yellow floating heart (*Nymphoides peltata*). Wetland and riparian zone invasive exotic plants in Washington include garden loosestrife (*Lysimachia vulgaris*), hairy willow-herb (*Epilobium hirsutum*), false indigo bush, Japanese knotweed (*Polygonum cuspidatum*), purple loosestrife (*Lythrum salicaria*), reed canarygrass, and saltcedar (*Tamarix ramosissima*) (Ecology 2015a).

3.4.3 Impact Assessment

3.4.3.1 Proposed Facility

Construction

Direct impacts to vegetation communities would occur as a result of vegetation removal resulting from Facility construction. Most of the construction (97 percent) would occur within industrial areas that currently have no vegetation. About 4.5 acres of vegetation would be removed during construction (Table 3.4-6). Most of the vegetation to be removed would be grasses and forbs in the unloading and office area (Area 200) for construction of the office building, in the marine terminal area (Area 400) for construction of the transfer pipeline, and in temporary construction and laydown areas. No riparian trees or vegetation would be removed. An area with 0.1 acre of upland cottonwood stands containing approximately 273 trees would be cleared for the transfer pipeline in the transfer pipeline area (Area 500) (Table 3.4-6). Removal of 246 of these trees has been permitted[2] for construction of a CPU substation (BergerABAM 2012). The pipeline would remove approximately one-third of the remaining 27 trees associated with the CPU project that are not already permitted for removal.

To compensate for impacts to the upland cottonwood stand, the Applicant proposes to adhere to VMC 20.770 and would plant a minimum of 30 tree units per acre for undeveloped sites. Based on a 10,550-square-foot development area, a minimum of eight tree units would be required. VMC 20.770.070(B) (4) allows trees planted in landscaped islands and other areas to meet the tree density requirements. The proposed Project includes a Landscaping Plan in Administrative and Support Buildings (Area 200) that calls for planting buffer landscape trees and parking lot trees that would exceed the eight tree units required for the Project under VMC 20.770 (BergerABAM 2012). The planted trees would be deciduous and planted at a minimum of 2-inch caliper. In total, about 2.2 acres of planted areas would be completed to compensate for the loss of upland cottonwood stand trees. Considering the Applicant’s intention to replace deciduous trees removed during construction and that removal of 8 to 9 trees is not a substantial amount, impacts to vegetation from Facility construction would be minor.

2 The City of Vancouver granted a shoreline substantial development permit, critical areas permit, and tree permit associated with the Port of Vancouver Clark Public Utilities substation project on November 30, 2012.

Table 3.4-6. Vegetation Removal During Construction of the Proposed Facility (Acres)

Vegetation Community	Administrative/ Support Buildings and Railcar Unloading Facility	Storage Tanks	Marine Terminal	Transfer Pipelines	Boiler Building	Rail Improvements	Total Permanent Effects	Total Temporary Effects
Ruderal Upland Grass/Forb	0.0	0.0	0.4	0.5	0.0	0.0	1.0	3.5
Upland Cottonwood Stands	0.0	0.0	0.0	0.07[a]	0.0	0.0	0.1	0.0
Riparian	0.0	0.0	0.00[b]	0.0	0.0	0.0	0.0	0.00[b]
Subtotal	0.0	0.0	0.4	0.6	0.0	0.0	1.0	3.5
Unvegetated Industrial	7.8	20.9	1.7	3.6	0.8	5.4	40.2	53.7
Total Acreage	7.8	20.9	2.2	4.1	0.8	5.4	41.2	57.1

Source: BergerABAM 2014b

Notes:

a Impacts to upland cottonwood stands include prior approvals for the construction of the CPU substation and total 0.8 acre. Actual impacts associated with the transfer pipeline that occur outside of previous approved tree removal are listed in this table.

b Facility elements would be constructed in an area with scarce riparian vegetation at the marine terminal (Area 400) covering approximately 0.8 acre. Temporary construction areas would cover approximately 0.03 acre. No high-quality riparian vegetation would be removed.

Dust generated during construction could disperse and fall on vegetation located outside active construction areas, including riparian vegetation near the marine terminal and east of the storage tank area and stands of cottonwood trees crossed by the transfer pipelines. Dust accumulation on leaf surfaces inhibits photosynthesis and reduces plant vigor and when accumulated on soil can increase bulk density and alter pH, potentially altering the suitability of the soil to support desired vegetation types. BMPs would be implemented during construction to reduce the generation of dust, such as covering dirt, gravel, and debris piles; covering truck loads, wetting materials in trucks, or providing adequate freeboard (space from the top of the material to the top of the truck bed) stockpiles of loose spoils; and spraying exposed soil with water or other suppressants. Implementing these BMPs would limit adverse effects of dust on vegetation to minor impacts.

Small leaks of hazardous materials such as fuel, oil, or antifreeze from construction equipment that reach vegetation and soil may kill vegetation. Diesel fuel and oils act as contact herbicides, killing surface cells and preventing transport across cell membranes. Short-chain and aromatic hydrocarbons cause the most damage by penetrating and destroying cell membranes, causing contact tissues to die (Walker et al. 1978, McKendrick 1999). If the tissues contacted are vital to the plant's survival, then the entire plant may die; if not, then only the affected tissues may die. Long-chain fractions coat the surface of leaves and stems, preventing normal gas exchange; if a sufficient area of the plant is covered, the plant may die (McKendrick 1999). Where diesel fuel penetrates soils, it also damages roots on contact and damages the soils creating hydrophobic conditions that limit availability of water to plants (McKendrick 1999). Soil-water relations remain impaired until microbes degrade the oil, which in turn imbalances carbon: nutrient ratios as microbe populations increase to decompose the hydrocarbons (McKendrick 1999). Because most vegetation in the proposed Facility area is weedy plants and sparse grasses, only minor impacts to vegetation from small leaks of hazardous materials would be expected.

Construction equipment can carry noxious weed seeds to and from other construction sites, and equipment can disperse seeds of existing onsite noxious weed populations. Newly disturbed ground is often first colonized by pioneering plants, many of which are noxious weeds. Noxious weeds can also be introduced during construction by use of contaminated seed mixes or contaminated mulch or erosion control materials.

To reduce and minimize the spread and establishment of noxious weeds, the Applicant would implement the following BMPs during construction:

- Wash equipment and vehicles before entering/leaving the proposed Facility
- Restrict construction activities to the area needed to work effectively, to limit the ground disturbance and prevent the spread of noxious weeds
- Use weed-free straw, hydromulch, or similar ground cover for temporary erosion control during construction

Assuming these BMPs would be effectively implemented, the potential for impacts due to the spread of noxious weeds from construction activities would be minor.

Operation and Maintenance

Impacts to vegetation could result from untreated stormwater runoff or inadvertent releases of small amounts of hazardous materials such as gasoline, diesel fuel, or oil from equipment and vehicles that reach vegetation. Stormwater would be managed through existing Terminal 4 and 5 stormwater systems, and Facility operations are not expected to result in releases of untreated stormwater.

To prevent inadvertent releases of hazardous materials, the Applicant would implement the following BMPs:

- Training personnel in proper handling techniques and emergency response procedures for chemical spills or accidental releases
- Providing appropriate hazardous material storage areas and containment
- Providing and maintaining current material safety data sheets as required by Washington Industrial Safety and Health Act of 1973 (WISHA) regulations

Assuming these BMPs would be effectively implemented, the potential for impacts to vegetation from the inadvertent releases of hazardous materials would be minor.

Facility operation could result in the spread of noxious weeds within, to, or from the Facility. Most disturbed areas would be revegetated or would contain buildings or impervious surfaces; however, the gravel railbed and other gravel surfaces may provide suitable growing conditions for noxious weeds. Uncontrolled weed populations can be spread by wind, water, animals, vehicles leaving the Facility, and railcars. Vehicles and railcars may also transport noxious weed seeds into the Facility during operation. Vegetation management practices to be implemented by the Applicant include maintaining areas clear of vegetation to reduce fire risk and management of noxious weed infestations. Mechanical vegetation clearing could spread seeds of noxious weeds if it facilitates shatter of seed pods for wind or water dispersal. Use of herbicides to control vegetation or weeds could lead to unintended effects on neighboring vegetation if precautions are not taken to prevent drift during application. In light of these vegetation management practices, the potential for impacts due to the spread of noxious weeds from operation and maintenance activities would be minor.

Decommissioning

Decommissioning activities could include demolition of buildings, pipelines, and storage tanks, which would have impacts similar to construction, including ground disturbances and inadvertent spills or leaks of small amounts of fuel or oil from equipment and vehicles. Dust would be generated, and grading of the gravel surfaces could cause release of incompletely recovered spilled materials. Ground disturbance and vehicles could result in the spread and establishment of noxious weeds. Assuming BMPs similar to those described for construction are implemented to protect vegetation during decommissioning, impacts from decommissioning activities would be minor

3.4.3.2 Rail Transportation

Vegetation communities within the rail corridor could be affected by leaks of small quantities of grease, oil, and fuel along the railways. Small spills and leaks would be expected to remain on the gravel railbed. Larger undetected leaks could spread into the ROW and affect vegetation including special-status plants that occur within the rail corridor (Table 3.4-2). Increased concentrations of hydrocarbons within the railbed, and potentially within adjacent soils, could result from the transportation of crude oil by unit trains. Review of railway contamination studies and studies in Poland found that contamination next to and between the rails results primarily from exhausted lubricate oils and condenser fluids, transportation of oil derivatives, metal ores, fertilizers and different chemicals, and application of herbicides (Wiłkomirski et al. 2011, 2012).

Rail lines act as a corridor for migration of plants as seeds or vegetative propagules that are carried and deposited along the tracks (Wiłkomirski et al. 2012). Noxious weeds and invasive plants may displace special-status plants from the rail corridor (Table 3.4-2) and degrade vegetation communities where they become established. Increased rail traffic may facilitate the rate at which noxious weeds are dispersed along the rail line. The incremental increase in rail traffic from the proposed Facility could contribute to moderate, long-term impacts to vegetation from incremental increases in contamination from small spills and in abundance and distribution of noxious and invasive weeds.

3.4.3.3 Vessel Transportation

Vessels transiting the Columbia River would create vessel wakes, which have the potential to impact riparian vegetation directly through breakage, swamping, and erosion and indirectly through altered patterns of erosion and deposition and spread of noxious weeds. Vessel wakes are most likely to affect shoreline vegetation communities at or near water level. Wakes can redistribute fine sediment that can smother aquatic vegetation, but can also provide substrate for colonization of emergent wetland plants.

Vessels traveling up and down the Columbia River could assist with dislodging (with wakes) and facilitating waterborne transport of wetland and riparian zone invasive exotic plants, including garden loosestrife, hairy willow-herb, indigo bush, Japanese knotweed, purple loosestrife, reed canarygrass, and saltcedar (Ecology 2015).

Wakes and wave action generated by the deep-draft vessels calling on the Facility would be greater than those associated with the smaller vessels historically typical on the Lower Columbia River. Vessels traveling upriver, holding only ballast, would likely generate smaller, less energetic waves than those laden with crude oil. Although the existing shoreline is exposed to vessel wakes as well as wind-driven waves, the expected increase in wave energy from vessels arriving at and transporting crude oil from the proposed Facility may create additional impacts of wakes on shoreline vegetation.

The incremental increase in vessel traffic associated with the Proposed Action would represent an approximately 223 percent increase over existing traffic levels.[3] While the increase in deep-draft vessel traffic could result in increases in the rate of shoreline erosion, this would primarily occur within the 16 percent of the lower river where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent.

Wake-induced erosion effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The incremental increase in deep-draft vessel traffic could contribute to moderate, long-term impacts to shoreline vegetation from wake-induced shoreline erosion and spread of invasive wetland and riparian plants.

3.4.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port and the following impacts to terrestrial vegetation from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue. Vegetation communities would continue to be affected by the noxious weeds present at the site, which would continue to proliferate without active management. Existing weeds would continue to be dispersed to surrounding areas by wind, water, and animals. The risk of contamination from fuels, lubricants, and oils would be reduced or eliminated; the impervious surfaces would continue to be inhospitable to development of native vegetation communities.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Construction under the No Action Alternative for these alternative uses would likely have similar vegetation impacts to the proposed Facility with conversion of vegetated areas to industrial use with soils replaced or covered by gravels and asphalt. Operation of these alternative uses could modify vegetation effects, with an increased risk of noxious weed introduction and spreading from grain, sand and gravel, and lumber operations.

3.4.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to terrestrial vegetation in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce impacts to terrestrial vegetation:

- Complete a weed survey for the proposed Facility site, followed by eradication of any noxious weeds and invasive plants currently established at the site prior to initiation of construction to help prevent the spread of noxious weeds to nearby wetland mitigation and wildlife areas.
- Include in the Landscaping Plan for the Administrative and Support Buildings (Area 200) the use of native trees planted in groups within the landscape to provide additional mitigation for the loss of trees onsite.

3 The increase in deep-draft vessel transits associated with the proposed Facility (365 per year) would represent an approximately 223 percent increase over the 164 deep-draft transits recorded by Ecology in 2013.

3.4.6 Significant Unavoidable Adverse Impacts

The incremental increase in rail traffic from the proposed Facility could contribute to moderate, long-term impacts to vegetation from incremental increases in contamination from small spills and in abundance and distribution of noxious and invasive weeds.

The incremental increase in deep-draft vessel traffic could contribute to moderate, long-term impacts to shoreline vegetation from wake-induced shoreline erosion and potential spread of invasive wetland and riparian plants.

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3.5 TERRESTRIAL WILDLIFE

This section describes the existing terrestrial wildlife resources at and near the proposed Facility at the Port and along the rail and vessel transportation corridors that would be used to transport crude oil to and from the proposed Facility. The affected environment described for wildlife resources includes areas that would experience direct and/or indirect effects from the proposed Facility and associated rail and vessel transportation, including areas potentially affected by a crude oil spill, fire, or explosion. Impacts to wildlife from an oil spill, fire, or explosion are discussed in Chapter 4. Descriptions of impacts to common wildlife species and threatened, endangered, or sensitive terrestrial wildlife from construction, operation and maintenance, and decommissioning of the proposed Facility, along with impacts from normal rail and vessel operations are provided herein. The Applicant completed a separate BE, which included one endangered and one threatened terrestrial wildlife species potentially affected by the Project and protected under the ESA (BergerABAM 2014a). The BE was developed as part of a separate permitting process by the USACE and was used to define impacts to ESA-listed species from the Proposed Action. Information from the BE has been incorporated into this section.

3.5.1 Methods of Analysis

The analysis of impacts to terrestrial wildlife considered impacts from Facility construction, including: loss or alteration of wildlife habitat; collision mortality and destruction of bird nests or small mammal burrows from equipment operation; noise disturbance from construction equipment operation and pile driving activities; and the adverse effects from small drips or leaks of fuel, hydraulic fluids, or oil from construction equipment. The analysis also considered the potential for impacts during Facility operation, including noise and lighting impacts; the addition of artificial perches, nesting sites, and roosts for nuisance birds and animals; blockage of reptile, amphibian, and small mammal movements; inadvertent spills or leaks of fuel, crude oil, and other fluids; and access to garbage or unsecured food waste leading to attraction of nuisance wildlife such as gulls, pigeons, rats, mice, and raccoons. The analysis of impacts to terrestrial wildlife within the rail corridor included reduced habitat suitability from incremental increases in barrier effects[1] and collision mortality and exposure to incremental increases in drips or leaks of small quantities of grease, oil, and fuel along the railways. Within the vessel corridor terrestrial wildlife could be affected by disturbance and noise generated by vessels, and by an incremental increase in potential injury from vessel strikes.[2]

The study areas used to describe the affected environment for terrestrial wildlife and to assess impacts, including the area potentially affected by a major oil spill, fire, or explosion, include:

- **The proposed Facility study area**—located at the Port, including the northwestern corner of Terminal 5, the storage tank area (Area 300), Berths 13 and 14 in Terminal 4, and pipeline areas that connect these three areas. The Facility study area includes the Project vicinity and areas within 2 miles of the proposed Facility site because wildlife is generally mobile and can be affected by noise, disturbance, and habitat connectivity at a distance.
- **The rail corridor study area**—includes the rail route from Williston, North Dakota, through Montana, Idaho, and the cities of Spokane and Pasco to the Port, including a 0.5-mile corridor along each side of the rail track. For the wildlife analysis, the rail corridor study area within Washington includes the inbound Columbia River Alignment and the outbound Central Return -

1 Barrier effects are physical or behavioral mechanisms that completely or partially block movements of wildlife.

2 A vessel strike is a collision between a vessel and wildlife such as birds or aquatic mammals that may be under, on, or over the water.

Stampede Pass Alignment, which would be used by empty unit trains leaving the Facility and returning to loading facilities in North Dakota.

- **The rail-Columbia River study area**—includes the corridor that extends 216 river miles along the Columbia River between Kennewick and the Port, including an area extending 1 mile downstream from the Port. This study area is used to address potential crude oil spills, fires, and explosions in Chapter 4. The rail-Columbia River corridor covers all contiguous side/off-channels,[3] sloughs,[4] and associated wetlands, and adjacent riparian and upland habitats within 0.25 mile of the river shoreline. The rail corridor study area and rail-Columbia River study area overlap and extend into Oregon.
- **The vessel corridor study area**—includes vessel routes between the Port and the Pacific Ocean; this extends 106 river miles along the Columbia River and includes all contiguous side/off-channels, sloughs and associated wetlands, and adjacent riparian and upland habitats within 0.25 mile of the river shoreline. The corridor extends offshore to the 3-nmi state lands limit of Washington state waters.

The affected environment for wildlife was developed based on identification of existing habitats and wildlife use within the study areas. The assessment of impacts to terrestrial wildlife is based in part on information provided by the Applicant (BergerABAM 2014b) and independently reviewed findings from the BE prepared for the USACE as part of the Section 10 and Section 404 permit review process (Berger ABAM 2014a) and supplemented with additional information. Analyses used the following data sources:

- Vegetation communities were reviewed based on the USGS GAP Land Cover Data Set (USGS 2011).
- WDFW PHS Program maps and online interactive mapping database were used to review and update information on wildlife in Washington provided by the Applicant (WDFW 2008, 2014).
- WDFW PHS Program maps and online interactive mapping database were used to review and update information on special-status wildlife occurrence within the proposed Facility, rail corridor, and vessel corridor study areas in Washington; the presence of suitable habitat was used to evaluate whether and when special-status species were likely to be present (WDFW 2008, 2014, 2015a).
- The USFWS website was consulted to review and update special-status species occurrence within the respective study areas in Washington, Idaho, Montana, and North Dakota (USFWS 2015a).
- Important Wildlife Areas in Washington, Idaho, Montana, and North Dakota were reviewed and updated based on the WDFW PHS Program (WDFW 2014), the GAP Land Cover Data Set (USGS 2011), and the GAP Protected Area Database (USGS 2012, Aycrigg et al. 2013).
- Sensitive species and species of concern were identified for the rail corridor study area based on the USFS and BLM Sensitive Species List (USFS and BLM 2011), the Idaho Comprehensive Wildlife Strategy (IDFG 2005), the Montana Natural Heritage Program (MNHP 2013), and the ODFW Sensitive Species List (ODFW 2008).

Special-status wildlife are those species that are listed as endangered, threatened, proposed, or candidates by the USFWS or National Marine Fisheries Service (NMFS) under the ESA; USFWS, USFS, and BLM

3 Aquatic habitats with direct connection to the basin's river network.

4 Swamp or shallow lake system, usually a backwater to a larger body of water.

species of concern or sensitive species; and state listed endangered, threatened, candidate, and sensitive species. Discussions of special-status species are included in the general discussions of terrestrial wildlife.

3.5.2 Affected Environment

3.5.2.1 Proposed Facility

Habitats and Common Wildlife

Wildlife habitats within 2 miles of the proposed Facility site are primarily Urban and Mixed Environs (51 percent); followed by Open Water (29 percent); Westside Riparian-Wetlands (11 percent); and Agricultural, Pasture, and Mixed Environs (9 percent; Figure 3.5-1 and Table 3.5-1). An area of less than 1 percent classified as Westside Lowland Conifer-Hardwood Forest was also identified (Table 3.5-1).

Table 3.5-1. Wildlife Habitat Types near the Proposed Facility

Habitat Type	Area* (acres)	Percentage (%)
Urban and Mixed Environs	6,323.0	51%
Westside Riparian-Wetlands	1,427.3	11%
Westside Lowland Conifer-Harwood Forest	36.8	< 1%
Agriculture, Pasture, and Mixed Environs	1,170.2	9%
Open Water-Lakes/Rivers	3,583.9	29%
Total	12,541.2	100%

Source: Northwest Habitat Institute, Figure 3.5-1
Note:
*Area within 2-mile radius of proposed Facility

Urban and Mixed Environs

The proposed Facility would be constructed primarily within Urban and Mixed Environs habitat (Figure 3.5-1). Vegetation types present include Unvegetated Industrial and Ruderal Upland Grass/Forb communities. This habitat type includes low canopy cover and tree density, a high percentage of exotics, and a poor vegetative structure (Johnson and O'Neil 2001). Vegetation exists in small, isolated patches and wildlife that use this habitat are generally well adapted to human activity. Wildlife may find shelter or nesting opportunities in buildings, signs, other structures, and landscape plantings. Buildings and pilings may provide roosts for birds and bats. Uncontained refuse in the vicinity may provide supplemental food and act as an attractant for nuisance wildlife such as crows, gulls, rats, raccoons, skunks, opossums, and coyotes.

Westside Riparian-Wetlands

Westside Riparian-Wetlands include forested and scrub-shrub wetlands, as well as persistent emergent wetlands with sphagnum bogs (Ecology 2005). The riparian margin of the Columbia River at the proposed Facility site has been highly altered with riprap bank armor, and has minimal riparian vegetation and no structural complexity. Common mammals at the proposed Facility site may include those that can tolerate disturbed environments, including cottontail rabbits, opossums, raccoons, coyote, squirrels, and common rodents. Common reptiles and amphibians that may use riparian-wetlands at the proposed Facility site include bull frogs, common garter snakes, and alligator lizards (Ecology 2005). The riparian-wetland areas at the Facility site may provide limited foraging habitat for resident and migratory songbirds, shorebirds, and raptors.

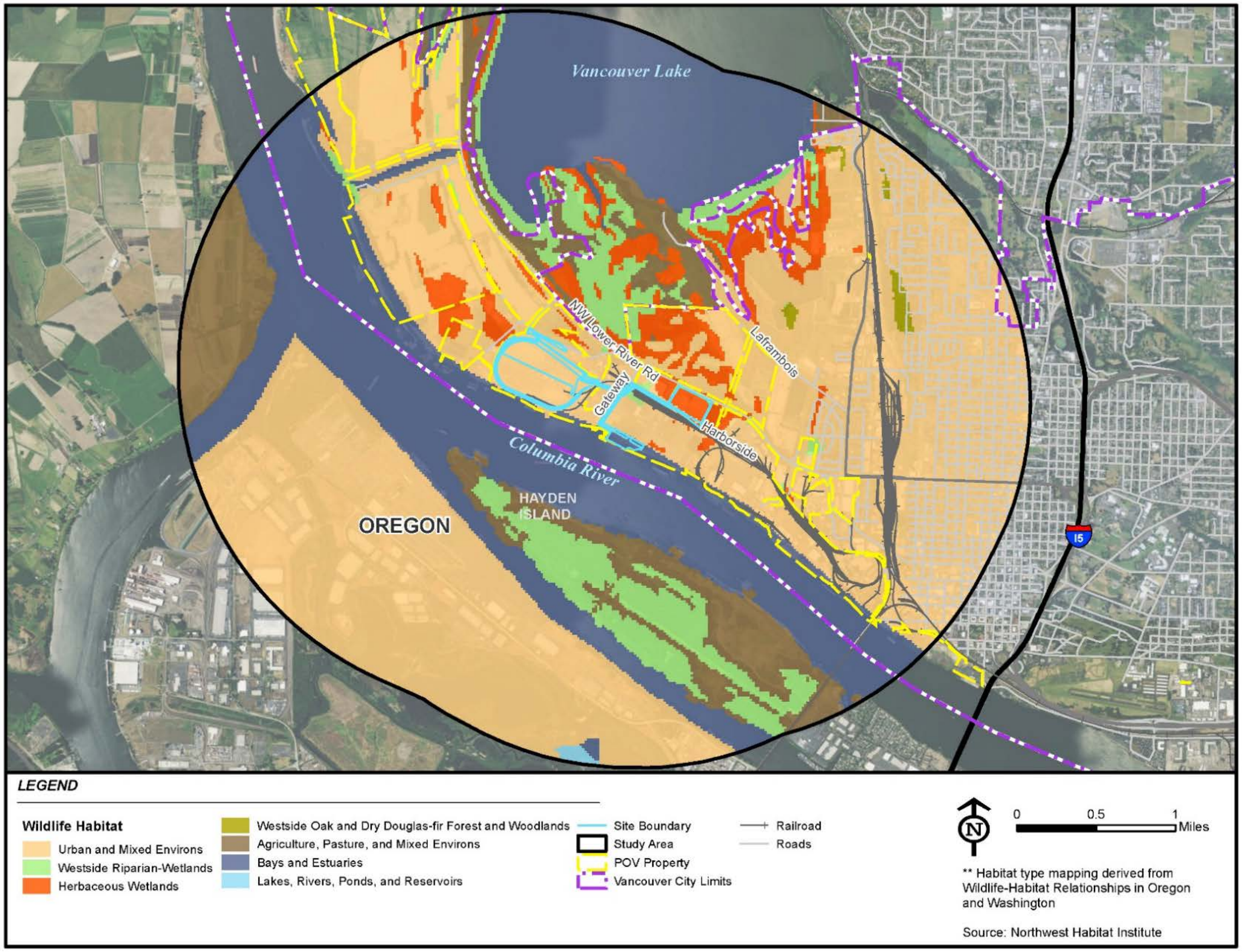

Figure 3.5-1. Wildlife Habitat Types near the Proposed Facility Site

Source: Northwest Habitat Institute

Within a 2-mile radius of the proposed Facility site, riparian-wetland habitat occurs on Hayden Island to the south and Vancouver Lake to the north and west (Figure 3.5-1). These riparian-wetlands, forest, and scrub-shrub communities are predominately black cottonwood, Oregon ash, and various willows. Cottonwood-dominated riparian forests border the Columbia River to the west of the proposed Facility site and to the south on Hayden Island. This reach of the Columbia River is industrialized and the shoreline is typically armored with riprap, which decreases habitat function. Some portions of the shoreline include sandy banks, scattered rock, and large woody debris. According to the Natural Resources Inventory Management Plan (Appendix D.9) completed for the Port in 2004, the shoreline area from Berth 10 to Berth 14 consists of moderately sloping, sandy shorelines with willows and cottonwoods colonizing portions of the riprap bank (Vigil Agrimis, Inc. and Herrera Environmental Consulting 2004). This stretch of sandy shoreline provides higher levels of habitat functions compared to steeply sloping, armored shorelines (Vigil Agrimis, Inc. and Herrera Environmental Consulting 2004).

Several wetland mitigation sites are located within the study area, including Parcel 1A wetland mitigation site (immediately east of the storage tank area), Parcel 2 mitigation site, and the CRWMB (Figure 3.3-12). Mitigation banks restore wetland habitat and function through restoration of wetland hydrology and replanting of native vegetation, thereby improving wildlife habitat. Several emergent wetlands occur on Port Parcels 3, 4, and 5, northwest of the Port's Terminal 5 site. These wetlands provide water quality functions, but because they have limited structural diversity, they may provide limited foraging and resting habitat functions. The southern end of Vancouver Lake, known as the Vancouver Lake Wildlife Area, lies within the 2-mile radius from the proposed Facility site. Vancouver Lake is part of Shillapoo Wildlife Area, which provides the highest-quality, least-disturbed riparian-wetland habitat within the study area.

Westside Riparian-Wetlands within these mitigation banks and the Vancouver Lake lowlands provide habitat for migratory and resident songbirds and waterfowl, with the greatest abundance of Pacific Flyway sandhill cranes and waterfowl during fall and winter, and mallards, pintails, wigeon, mergansers, gadwalls, green-winged teal, Canada geese, and snow geese. Great blue herons and bald eagles nest within this habitat (WDFW 2006), and an eagle territory is established north of the proposed Facility site (WDFW 2008, 2014). Mammals associated with riparian-wetlands include beaver, mink, river otter, raccoon, coyote, bats, rabbits, bobcat, deer, opossum, and rodents. Reptiles and amphibians in riparian-wetlands include snakes, turtles, alligator lizards, salamanders, newts, toads, and frogs (Ecology 2005).

Westside Lowland Conifer-Hardwood Forest

The study area includes a few upland fragments of Westside Lowland Conifer-Hardwood Forests dominated by black cottonwood and Oregon ash (Figure 3.5-1 and Table 3.5-1). These fragmented stands may provide refuge and foraging habitat for small mammals, such as rabbits, opossums, squirrels, raccoons, and bats, and perching and nesting habitat for raptors and songbirds.

Agricultural, Pasture, and Mixed Environs

Agricultural lands are present within the study area to the northeast and west of the proposed Facility site. These areas include Urban and Mixed Environs that surround agricultural land as well as areas on Hayden Island and in the Vancouver Lake lowlands (Figure 3.5-1; Johnson and O'Neil 2001). The Port's Parcel 3 east and northeast of the Terminal 5 site includes 517 acres that are leased for agriculture and used for row crops and pasture for horses and cattle. The eastern portion of this parcel includes a few remnant sloughs. The northernmost of these sloughs is hydrologically connected to the Parcel 2 wetland mitigation site. These sloughs and fields provide foraging habitat for geese and sandhill cranes, migratory songbirds, and a variety of small mammals such as mice, voles, and squirrels.

Priority Habitats

WDFW defines priority habitats as those with types or elements that have unique or significant value to a diverse assemblage of species (WDFW 2008, 2014). Priority habitats present within 2 miles of the proposed Facility site include 37.7 acres of oak woodland, 2.9 acres of lacustrine littoral wetlands, 122.5 acres of riverine tidal wetlands, and 1,774.3 acres of palustrine wetlands (WDFW 2008, 2014).

Oak Woodlands

Oak woodlands contain Oregon white oak, Washington's only native oak (Larson and Morgan 1998). Oaks and their associated ecosystem are limited and declining. Oak forests provide a variety of associated plant communities and mixed stand ages that contribute to wildlife diversity (Larson and Morgan 1998). Oak woodlands provide a mix of feeding, resting, and breeding habitat for over 200 vertebrates and a profusion of invertebrates, including habitat for species that are state listed as sensitive, threatened, endangered, or candidates for listing (Larsen and Morgan 1998).

Wetlands

Wetlands contribute to species richness and abundance in a landscape by providing structural complexity, connectivity with other ecosystems, abundant food sources and available water, and a moist and moderate microclimate (Sheldon et al. 2005).

Westside Riparian-Wetlands support 256 wildlife species, including 2 closely associated reptiles, 15 closely associated amphibians, 38 closely associated birds, and 20 closely associated mammals (Sheldon et al. 2005).

Herbaceous Wetlands, including palustrine and lacustrine wetlands, support 228 wildlife species, including 13 closely associated amphibians, 71 closely associated birds, and 16 closely associated mammals (Sheldon et al. 2005).

Some native amphibians only breed for a short time in wetlands and then live in uplands as adults (Sheldon et al. 2005). Others are found in or near wetlands throughout the year, although the eggs and larvae of all wetland-breeding amphibians require water for development (Sheldon et al. 2005). Birds that are closely associated with wetlands depend on them for part or all of their requirements for food, shelter, breeding, or resting. Wetlands associated with stream corridors characteristically have a greater diversity of mammals than upland sites and provide habitat for some mammals that are not found elsewhere. About half of the mammals using riparian wetlands in the Pacific Northwest use wetlands for both breeding and foraging; the remainder use wetlands primarily for foraging (Sheldon et al. 2005).

Priority Wildlife and Vulnerable Aggregations

WDFW tracks vulnerable wildlife aggregations[5] and wildlife of recreational, commercial, or tribal importance to provide habitat use data for management purposes (WDFW 2014). Three types of priority or vulnerable waterbird aggregations occur within 2 miles of the proposed Facility site: mid-summer shorebird concentrations (shorebird concentrations); mixed winter concentrations of geese, ducks, swans, and other waterbirds (waterfowl concentrations); and winter concentrations of dusky Canada geese (Table 3.5-2).

Large concentrations of shorebirds use mudflats in the area for foraging beginning in mid-summer when the water level drops and exposes mudflats. Common shorebirds include plovers, sandpipers, yellowlegs, dunlins, whimbrel, sanderling, dowitchers, and phalaropes. Winter waterfowl habitat complexes in the area are characterized by wetlands, lakes, streams and associated shorelines, and tidal influence. Pasture and crop lands in the area support wintering waterfowl concentration. This area is heavily used by lesser

5 A wildlife aggregation is a group of animals that are commonly found together.

and dusky Canada geese, cackling geese, and mallard, wigeon, and pintail ducks. Wintering and migrating geese use this area from October through April 15. Ridgefield Lowlands support wintering concentrations of Canada geese, sandhill cranes, tundra swans, white-fronted geese, and dabbling ducks, as well as nesting ducks in spring and summer. The Buckmire Slough area is used for nesting by several types of cavity-nesting ducks, including wood ducks and Barrow's goldeneye. Both wood ducks and Barrow's goldeneye may occur in the Project vicinity year-round, and breeding concentrations of wood ducks have been documented in forested habitat next to Vancouver Lake and Buckmire Slough.

Table 3.5-2. Priority Wildlife and Vulnerable Aggregations Occurring at and Near the Proposed Facility Site

Animal or Group Type	PHS Listing Criterion*	Potential for Occurrence	
		Facility Site	Within 2-Mile Radius of Facility Site
Birds			
Cavity-nesting ducks (multiple species)	3	Low – No suitable habitat onsite	High – Documented breeding areas and suitable breeding habitat for several species in Buckmire Slough vicinity (12.6 acres)
Shorebird concentrations (multiple species)	2	Moderate – Riparian and aquatic zone provides opportunities for foraging	High – Regular concentrations of shorebirds documented on Vancouver Lake, near Inner Vancouver Lake - Lake Flushing Channel Area (6.1 acres)
Waterfowl concentrations (multiple species)	3	Moderate – Riparian and aquatic zone provides opportunities for foraging	High – Documented winter concentrations throughout Vancouver Lake Lowlands including Salmon Creek Wintering Waterfowl Habitat, Vancouver Shillapoo Lake Agricultural Lands, and Ridgefield Lowlands (7,042.2 acres)
Dusky Canada goose (*Branta canadensis occidentalis*)	2, 3	Low – No suitable habitat onsite	High – Documented winter concentrations in Vancouver Shillapoo Lake Agricultural Lands (579.6 acres)
Great blue heron (*Ardea herodias*)	2	Low – No suitable habitat onsite	High – Documented breeding occurrences; 1 rookery about 0.5 mile north of the proposed Facility on Vancouver Lake and 1 rookery on Buckmire Slough

Source: WDFW 2015b

Note:

*WDFW PHS Listing Criteria: Criterion 1 = state-listed endangered, threatened, and candidate species; Criterion 2 = vulnerable aggregations; Criterion 3 = species of recreational, commercial, or tribal importance.

Special-Status Wildlife

The proposed Facility site provides little suitable habitat for special-status wildlife. However, habitats within 2 miles of the proposed Facility site, including the Vancouver Lake Wildlife Area and the CRWMB, provide habitat for special-status species. Three special-status birds have been documented using the area within 2 miles of the proposed Facility site: bald eagle, purple martin, and sandhill crane (Table 3.5-3; WDFW 2008, 2015a, b).

Appendix I provides information on each species' life history, listing status, and potential to occur within the proposed Facility site or vicinity based on an evaluation of the presence or absence of appropriate habitat for each species (BergerABAM 2014b).

Table 3.5-3. Special-Status Terrestrial Wildlife with Potential for Occurrence at and Near the Proposed Facility Site

Common Name *(Scientific Name)*	Federal		State			Potential for Occurrence	
	ESA Listing Status[a]	Critical Habitat	State Listing Status[b]	PHS Listing Criterion[c]	Species of Greatest Conservation Need[d] (Y/N)	Facility Site	Within 2-Mile Radius of Facility Site
Amphibians							
Oregon spotted frog *(Rana pretiosa)*	FT	N/A	SE	1	Y	Low – No suitable habitat onsite	Moderate – Suitable aquatic habitat in vicinity of Vancouver Lake and adjacent wetlands, but no documented occurrences
Western toad *(Bufo boreas)*	FSC	N/A	SC	1	Y	Low – No suitable habitat onsite	Moderate – Potentially suitable habitat throughout Vancouver Lake Lowlands, but no recently documented occurrences
Reptiles							
Pacific pond turtle (*Actinemys marmorata*)	FSC	N/A	SE	1	Y	Low – No suitable habitat onsite	Moderate – Suitable habitat throughout Vancouver Lake Lowlands, but no documented occurrences
Birds							
Aleutian Canada goose *(Branta hutchinsii [canadensis] leucopareia)*	FSC - delisted	N/A	None	None	N	Low – No suitable habitat onsite	Moderate – Potentially suitable migratory habitat in wetlands adjacent to Vancouver Lake and agricultural lands on Parcel 3
Bald eagle (*Haliaeetus leucocephalus*)	None	N/A	SS	1	Y	Moderate – Low-quality foraging habitat in riparian zone	High – Documented nesting occurrences in Columbia River riparian forested habitats: 3 nest sites, 1 regularly used winter/early spring concentration area in Vancouver Lake (9.9 acres), and 1 regular high-use area in Mulligan Slough (72.8 acres)
Common loon (*Gavia immer*)	None	N/A	SS	1, 2	Y	Low – No suitable habitat onsite	Moderate – One or more documented occurrences and potentially suitable habitat at Vancouver Lake
Lewis' woodpecker (*Melanerpes lewis*)	None	N/A	SC	1	Y	Low – No suitable habitat onsite	Low – Potentially suitable habitat throughout lowlands, but not documented extensively in Clark County
Marbled murrelet (*Brachyramphus marmoratus*)	FT	Designated	ST	1, 2	Y	Low – No suitable habitat	Low – No suitable habitat
Olive-sided flycatcher *(Contopus cooperi)*	FSC	N/A	None	N/A	N	Low – No suitable habitat onsite	Low – No mature coniferous forest habitat is present within the Project vicinity

Table 3.5-3. Special-Status Terrestrial Wildlife with Potential for Occurrence at and Near the Proposed Facility Site

Common Name (*Scientific Name*)	Federal		State			Potential for Occurrence	
	ESA Listing Status[a]	Critical Habitat	State Listing Status[b]	PHS Listing Criterion[c]	Species of Greatest Conservation Need[d] (Y/N)	Facility Site	Within 2-Mile Radius of Facility Site
Peregrine falcon (*Falco peregrinus*)	FSC	N/A	SS	1	Y	Moderate – Low-quality foraging habitat present	Moderate – One or more historical documented nesting occurrences in vicinity; known to nest on the I-5 bridge
Pileated woodpecker (*Dryocopus pileatus*)	None	N/A	SC	1	Y	Low – No suitable habitat onsite	Moderate – Riparian cottonwood forests provide potentially suitable foraging habitat
Purple martin (*Progne subis*)	None	N/A	SC	1	Y	Low – No suitable habitat onsite	High – Documented nesting habitat and regular concentrations near Vancouver Lake; Vancouver Lake nesting gourds established in 1997
Sandhill crane (*Grus canadensis*)	None	N/A	SE	1	Y	Low – No suitable habitat onsite	High – Documented regular concentrations throughout Vancouver Lake Lowlands, particularly on agricultural lands at Parcel 3; 5 occurrences ranging from several dozen to over 100 during October to December
Short-tailed albatross *(Phoebastria albatrus)*	FE	Not Designated	SC	1	Y	Low – No suitable habitat	Low – No suitable habitat
Slender-billed white-breasted nuthatch *(Sitta carolinensis aculeata)*	FSC	N/A	SC	1	Y	Low – No suitable habitat onsite	Moderate – One or more documented occurrences near Vancouver Lake
Streaked horned lark *(Eremophila alpestris strigata)*	FT	Designated	SE	1	Y	Low – No suitable habitat onsite	Moderate – Documented occurrence on dredge material placement sites and barren lands throughout Lower Columbia River
Vaux's swift *(Chaetura vauxi)*	None	N/A	SC	1	Y	Low – No suitable habitat onsite	Low – Limited presence of large snags for nesting in vicinity
Western snowy plover *(Charadrius nivosus nivosus)*	FT	Designated	SE	1	Y	Low – No suitable habitat	Low – No suitable habitat

Table 3.5-3. Special-Status Terrestrial Wildlife with Potential for Occurrence at and Near the Proposed Facility Site

Common Name *(Scientific Name)*	Federal		State			Potential for Occurrence	
	ESA Listing Status[a]	Critical Habitat	State Listing Status[b]	PHS Listing Criterion[c]	Species of Greatest Conservation Need[d] (Y/N)	Facility Site	Within 2-Mile Radius of Facility Site
Mammals							
Columbian white-tailed deer *(Odocoileus virginianus leucurus)*	FE	Not Designated	SE	1	Y	Low – No habitat	Low – No habitat
Gray-tailed vole *(Microtus canicaudus)*	None	N/A	SC	1, 2	Y	Moderate – Ruderal Grass/Forb Habitat may provide limited habitat	Moderate – Agricultural Lands, Pastures, and Fields provide suitable habitat
Long-eared myotis (*Myotis evotis*)/ Long-legged myotis (*Myotis volans*)	FSC	N/A	None	N/A	N	Low – No suitable habitat onsite	Moderate – Potentially suitable foraging habitat throughout Vancouver Lake Lowlands, but limiting roosting habitat
Pacific Townsend's big-eared bat *(Corynorhinus townsendii townsendii)*	FSC	N/A	SC	1, 2	Y	Low – No suitable habitat onsite	Moderate – Potentially suitable foraging habitat throughout Vancouver Lake Lowlands, but limiting roosting habitat

Source: BergerABAM (2014b), WDFW (2015b)

Notes:

a ESA Classifications: FE = federal endangered; FT = federal threatened; FSC = species of concern; FC = federal candidate

b Washington Species Classifications: SE = state endangered; ST = state threatened; SC = state candidate; SS = state sensitive

c WDFW PHS Listing Criteria: Criterion 1 = state-listed and candidate species; Criterion 2 = vulnerable aggregations; Criterion 3 = species of recreational, commercial, or tribal importance

d As defined in WDFW's Comprehensive Wildlife Conservation Strategy (WDFW 2005)

3.5.2.2 Rail Corridor

Wildlife Habitats

The rail corridor study area within Washington, which for the purpose of this analysis includes the inbound Columbia River Alignment and outbound Central Return - Stampede Pass Alignment, crosses many different types of wildlife habitats located on both publically and privately owned land. Many of these habitats are protected lands owned in-fee by agencies and nonprofits and are managed to preserve biological diversity and other natural, recreation, and cultural uses (Table 3.5-4; USGS 2012). Protected lands along the rail-Columbia River study area corridor include WDFW Wildlife Areas, WDNR Natural Areas, and USFWS National Wildlife Refuges.

Table 3.5-4. Wildlife Areas Managed for Biological Diversity and Multiple Use by Land Ownership and GAP Status Within the Rail and Vessel Transportation Corridors in Washington

Protected Area Land Ownership or GAP Status[a]	Rail Corridor: Columbia River Alignment (acres)	Rail Corridor: Rail-Columbia River (acres)	Rail Corridor: Central Return - Stampede Pass Alignment (acres)	Vessel Corridor (acres)
Land Ownership				
Federal	758.7	15,607.2	11,090.8	19,539.2
State	6,206.0	4,399.3	15,109.3	4,108.8
Tribal	0	0	0	0
Special district	0.0	294.3	0.0	0.0
Local government	256.4	267.6	8,548.3	0.0
Nongovernmental organization	59.7	32.6	238.3	175.3
Private	0.0	2,444.8	20.2	0.0
Total Protected Area[b]	7,280.8	23,045.7	35,006.9	23,825.5
Total Corridor Land Area	189,064.6	79,389.8	232,693.9	73,845.0
GAP Status				
GAP Status 1 Area	40.1	0.0	115.9	20.8
GAP Status 2 Area	1,132.6	14,053.2	15,049.5	20,523.7
GAP Status 3 Area	6,108.1	8,992.5	19,841.5	3,281.0
Total Protected Area	7,280.8	23,045.7	35,006.9	23,825.5
Total Corridor Land Area	189,064.6	79,389.8	232,693.9	73,845.0

Source: USGS (2012)

Notes:

a GAP Status: 1 = Managed for biodiversity – natural disturbances allowed, 2 = Managed for biodiversity – natural disturbances suppressed, 3 = Managed for multiple use – majority of area maintained in natural cover

b Total Protected Area, defined as GAP Status 1, 2, or 3, is a subset of lands within the Total Land Corridor Area

In Washington the inbound Columbia River Alignment route crosses through the Franz Lake (38 acres), Pierce (12 acres), Steigerwald Lake (151 acres), Turnbull (39 acres), and Umatilla (518 acres) National Wildlife Refuges (USGS 2012). WDFW Wildlife Areas crossed include the Columbia Basin (145 acres) and Sunnyside-Snake River (180 acres) Wildlife Areas. Private natural areas include the Lind Shrub-Steppe Preserve (40 acres) and the Wetland Reserve Program (173 acres; USGS 2012).

The Central Return - Stampede Pass route would cross near or through wildlife habitats in the Nisqually National Wildlife Refuge, the Snoqualmie and Wenatchee National Forests, the Fort Lewis Military Reserve, and the USACE's Howard Hanson Reservoir.

Priority Habitats

Ten terrestrial WDFW priority habitat types occur within the rail and vessel corridors in Washington (Table 3.5-5; WDFW 2015b). The most abundant priority habitat crossed by the rail corridor is shrub-steppe (6.1 percent), followed by prairies and steppe (1.3 percent; Table 3.5-5). Priority habitats cover 13 percent of the rail corridor along the Columbia River Alignment, 11 percent of the rail-Columbia River corridor, 12 percent of the Central Return - Stampede Pass Alignment, and 6 percent of the vessel corridor (WDFW 2015b).

Table 3.5-5. WDFW Priority Habitat Types within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Priority Habitat Type	Rail Corridor: Columbia River Alignment		Rail Corridor: Rail-Columbia River*		Rail Corridor: Central Return - Stampede Pass Alignment*		Vessel Corridor*	
	Acres (%)	Number	Acres (%)	Number	Acres (%)	Number	Acres (%)	Number
Biodiversity areas and corridors	1,364.5 (0.7%)	8	897.9 (1.1%)	5	12,782.9 (5.5%)	17	2,178.2 (2.9%)	6
Caves/cave-rich areas	--	--	--	--	--	--	9.4 (<0.1%)	1
Cliffs/bluffs	2,297.2 (1.2%)	11	2,100.1 (2.6%)	12	1,146.0 (0.5%)	13	684.8 (0.9%)	1
Herbaceous bald	91.8 (<0.1%)	3	18.8 (<0.1%)	2	--	--	--	--
Oak woodlands	892.2 (0.5%)	5	219.1 (0.3%)	3	556.0 (0.2%)	7	30.6 (<0.1%)	2
Prairie	--	--	--	--	209.7 (0.1%)	1	--	--
Prairies and steppe	3,235.6 (1.7%)	3	--	--	--	--	--	--
Shrub-steppe	15,019.7 (7.9%)	9	4,693.5 (5.9%)	7	10,268.2 (4.4%)	16	--	--
Talus slopes	967.9 (0.5%)	11	620.8 (0.8%)	7	--	--	--	--
Wetlands	413.2 (0.2%)	6	402.9 (0.5%)	4	2,569.4 (1.1%)	25	1,480.5 (2.0%)	9

Sources: WDFW (2015b)

Notes:

Occurrences are repeated within each corridor where corridors overlap; -- = does not occur within corridor.

* Percentages based on total land area for each corridor: Columbia River Alignment = 189,064.6 acres; Rail-Columbia River Corridor = 79,389.8 acres; Central Return - Stampede Pass Alignment = 232,693.9 acres; Vessel Corridor = 73,845.0 acres

Biodiversity Areas and Corridors

Biodiversity areas and corridors are expanses of habitat that are relatively important to various species of native fish and wildlife (WDFW 2008). Biodiversity areas contain habitat that is valuable to fish and wildlife and mostly comprise native vegetation. They occur in remote areas but also within cities and urban growth areas. They support a diverse community of species as identified by a qualified professional (WDFW 2008). Biodiversity corridors are relatively undisturbed and continuous tracts of vegetation that connect habitat conservation areas, priority habitats, biodiversity areas, or valuable habitats within a city or urban development area. Biodiversity corridors allow wildlife species to safely move between these high-quality habitats, thereby preventing isolation and reduced fitness between populations (WDFW 2008).

Cliffs and Bluffs

Cliff and bluff environments are shaped by the local rock type and strength, climate, aspect, and weathering patterns in the area. Cliffs support high endemism[6] of plants and refugia[7] for old trees as well as habitat for roosting or nesting birds and bats. Cliffs are impacted and disturbed by road construction, recreation (climbing), and mining (WDNR 2011a).

Herbaceous Balds

Herbaceous balds are variable-sized patches of grass and forb vegetation located on shallow soils over bedrock that is commonly fringed by forest or woodland (WDFW 2008). Vegetation includes herbaceous vegetation, dwarf shrubs, mosses, and lichens. Rock outcrops, boulders, and scattered trees are often present. Balds occur within mid-montane to lowland forest zones (WDFW 2008). Balds are inordinately important for biodiversity conservation in relation to their small total extent. They tend to have higher plant diversity than the surrounding forest and host a relatively high percentage of the total flora in western Washington (Chappell 2006). Some sensitive animal species, especially butterflies, are confined to these small habitats. The Taylor's checkerspot butterfly (*Euphydryas editha taylori*) is limited to these habitats and closely similar ones (Chappell 2006). The exclusion of fire from this habitat type over the last 100 years has resulted in tree and shrub encroachment, which leads to the conversion of herbaceous balds to shrublands or forests in many areas. Prescribed burning has been used in some areas to prevent encroachment and improve this habitat type (WDNR 2011b). Development has also resulted in the decline of this habitat type (WDNR 2011b).

Oak Woodlands

As described previously, oak woodlands are limited and declining in Washington. They are a priority habitat along the rail corridor, providing a mix of feeding, resting, and breeding habitat for over 200 vertebrates and a profusion of invertebrates, including species that are state listed as sensitive, threatened, endangered, or candidates for these listings (Larsen and Morgan 1998).

Prairie and Steppe

Prairies and steppes are nonforested vegetation types dominated by forbs and grasses (WDFW 2008). Steppes in areas with greater precipitation or on moister soils are characterized by a very dense cover of native perennial forbs and bunchgrasses. Shrubs are either absent or scattered in the overstory of steppe habitat (WDFW 2008). Both dry and wet prairies occur in Washington. Dry prairies occur in areas with less precipitation and dryer soils and can include shrubs such as black hawthorn (*Crataegus douglassii*), kinnikinnick (*Arctostaphylos uva-ursi*), and oval-leaf viburnum (*Viburnum ellipticum*). Wet prairies in the Lower Columbia - Willamette region of southwestern Washington occur on clay-rich soils that are saturated to the surface during the early part of the growing season, gradually drying out during the

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6 Endemism is a species being unique to a defined geographic location.

7 Refugia is an area enabling a species or a community of species to survive.

summer. Wet prairies in the Puget Trough generally are found on glacial outwash soils that typically are limited to swales or low-gradient riparian areas (WDFW 2008). Prairies and steppes provide important habitat for native wildlife, such as elk, deer, pocket gophers, western meadowlark, Oregon vesper sparrow, and streaked horned lark. Additionally, several species of frogs, toads, snakes, and turtles are associated with open grasslands. The endangered Fender's blue butterfly and the Taylor's checkerspot also depend on prairie habitat. Loss and fragmentation of prairie habitat has resulted in genetic isolation of small-bodied animals (amphibians, reptiles, small mammals, and invertebrates), and the small size of the remaining prairie patches may be inadequate to support populations of larger-bodied animals (USFWS 2010). Prairies and steppes are being impacted by livestock practices, invasive species, fire regime alteration, direct soil surface disturbance, and fragmentation (WDNR 2011b). Excessive grazing stresses these habitats through soil disturbance, trampling and displacing the biological soil crust, altering the composition of perennial species, and increasing the establishment of invasive grass species (WDNR 2011c).

Shrub-Steppe

Shrub-steppe is one of Washington's most richly diverse habitats and home to some species found nowhere else in the state. A large portion of this habitat type has been lost or disturbed in the state by development. This habitat is a nonforested vegetation type that consists of layers of perennial bunchgrasses and a discontinuous layer of shrubs (Azerrad et al. 2011). Shrub-steppe habitat supports many closely associated wildlife species, one of which is federally listed (pygmy rabbit) and several that are state listed. Other closely associated species, such as greater sage-grouse are federal ESA candidates. Additional sagebrush-obligate species may eventually require ESA protection if the pace of habitat loss does not decelerate (Azerrad et al. 2011).

Talus Slopes

Talus slopes are cliff habitats with less than 10 percent vegetation cover and include large areas of bare rock. Talus is the accumulation of broken rock that lies at the base of a steep mountain or cliff. Talus slopes are found from foothill to subalpine elevations (WDNR 2011a). Small patches of vegetation in this habitat include scattered trees and/or shrubs, with occasional small dense patches of shrubs or herbaceous plants. Talus slopes are a unique habitat supporting high endemism of plants, nesting habitat for birds, and refugia for other wildlife (WDNR 2011a). They are impacted and disturbed by road construction, recreation (climbing), and mining (WDNR 2011a).

Wetlands

Riverine tidal and palustrine wetlands contribute to species richness and abundance in a landscape by providing structural complexity, connectivity with other ecosystems, abundant food sources and available water, and a moist and moderate microclimate (Sheldon et al. 2005). As described previously in Section 3.5.2.1, Westside Riparian-Wetlands support 256 wildlife species, including reptiles, amphibians, birds, and mammals (Sheldon et al. 2005).

Priority Wildlife and Vulnerable Aggregations

Priority wildlife occurring within the rail, rail-Columbia River, and vessel corridors are listed in Table 3.5-6 (WDFW 2015b). Vulnerable bird aggregations may include breeding waterfowl, shorebirds, and seabirds during spring and summer, and migrating and wintering waterfowl and shorebirds. Upland game birds (native and introduced) that occur within the rail corridor include band-tailed pigeons, quail, grouse, pheasants, and turkeys. Fall and winter waterfowl aggregations are popular hunting areas. Game mammals that occur within the rail corridor include bighorn sheep, elk, and deer. Roosting concentrations of bats also occur within cliffs and bluffs along the rail corridors based on acoustic detections (Table 3.5-6; WDFW 2015b).

Special-Status Wildlife

Special-status wildlife that occur within the rail corridor and adjacent rail-Columbia River corridor are listed in Table 3.5-7 (WDFW 2015b). Special-status wildlife include threatened, endangered, proposed, or candidate species under the ESA; USFWS, USFS, or BLM species of concern or sensitive species; and state-listed, threatened, endangered, candidate, or sensitive species. The ODFW assigns sensitive wildlife into two subcategories, "Critical" or "Vulnerable." Critical sensitive species are imperiled, with extirpation from a specific geographic area of the state due to small population sizes, habitat loss or degradation, and/or immediate threats. Critical species may decline to the point of qualifying for threatened or endangered status if conservation actions are not implemented. Vulnerable sensitive species are facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled with extirpation from a specific geographic area of the state but could be with continued or increased threats to existing populations or habitats (ODFW 2008). Three special-status amphibians, 3 reptiles, 20 birds, and 9 mammals are documented to occur along the rail corridor route between Vancouver and Spokane (Table 3.5-7). Five special-status insects, 4 amphibians, 2 reptiles, 18 birds, and 10 mammals are documented to occur along the Central Return - Stampede Pass route.

Wildlife Habitat in Idaho, Montana, and North Dakota

The majority of the rail corridor outside of Washington would cross through Montana (85 percent), followed by Idaho (12 percent) and then North Dakota (3 percent; Table 3.4-3). While many areas adjacent to rail corridors are developed, the rail corridor would also cross through undeveloped areas including National Forests, Glacier National Park, Bowdoin National Wildlife Refuge, and numerous state Wildlife Management Areas.

The route through Idaho crosses forests and woodlands (52 percent), which are predominately montane mixed conifer forests (75 percent) and ponderosa pine woodland and savanna (21 percent; Table 3.4-3). The route through Montana crosses agricultural or developed lands (44 percent), forested lands (26 percent), and shrublands and grasslands (17 percent; Table 3.4-3). The route through North Dakota crosses agricultural or developed lands (43 percent), followed by shrublands and grasslands (35 percent) and forested lands (14 percent; Table 3.4-3).

Important wildlife habitats include protected lands that are managed for biological diversity and for multiple uses, with the majority of the protected area crossed by the rail corridor being managed for biological diversity (Table 3.5-8; USGS 2012). Notable protected areas crossed in Idaho include the Idaho Panhandle and Kootenai National Forest and Lake Pend Oreille (USGS 2012). Important protected areas crossed in Montana include Flathead and Kootenai National Forests, Glacier National Park, and the Blackfeet, Fort Belknap, and Fort Peck Reservations (USGS 2012). Protected areas crossed in North Dakota include Lake Sakakawea and Lewis and Clark Wildlife Management Area (USGS 2012). About 4.1 percent of the rail corridor in Idaho, Montana, and North Dakota crosses through lands managed for biological diversity and 15.2 percent crosses through multiple-use lands (Table 3.5-8).

Special-Status Wildlife

Four federal ESA-listed endangered animals, seven threatened animals, and two candidates for listing may occur within or near the rail corridor in Idaho, Montana, and North Dakota (Table 3.5-9). The USFS (USFS 2011) and BLM (BLM 2009) sensitive species listings include numerous animals that could occur within the rail corridor. These sensitive animals would be protected on federal lands.

Table 3.5-6. Priority Wildlife and Vulnerable Aggregations within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Group Type or Common and *Scientific Name*	PHS Listing Criterion[a]	Occurrences within Corridors[b]			
		Rail	Rail-Columbia River	Central Return – Stampede Pass	Vessel
Bird Aggregations					
Cavity-nesting ducks – breeding occurrence: wood duck (*Aix sponsa*), Barrow's goldeneye (*Bucephala islandica*), common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), or hooded merganser (*Lophodytes cucullatus*)	3	--	--	469.6 acres (5B)	540.1 acres (3B)
Cavity-nesting ducks – regular concentration: wood duck, Barrow's goldeneye, common goldeneye, bufflehead, or hooded merganser	3	--	--	--	1,250.9 acres (3R)
Eastern Washington breeding areas of seabirds: gulls	2	9.5 acres (1B)	--	--	--
Western Washington breeding area concentrations of seabirds: cormorants, storm-petrels, terns, alcids, and gulls	2	--	--	--	1,002.8 acres (2B)
Western Washington nonbreeding concentrations of seabirds: loons, grebes, cormorants, fulmar, shearwaters, storm-petrels, and alcids	2	--	--	584.4 acres (3R)	4,067.3 acres (7R)
Waterfowl concentrations – significant breeding areas and regular concentrations in winter (excluding Canada geese in urban areas)	2, 3	12,348.9 acres (1B, 24R)	18,975.8 acres (24R)	13,773.2 acres (5B, 23R)	30,440.1 acres (17R)
Western Washington nonbreeding concentrations of plovers, sandpipers, and Wilson's phalarope	2	--	--	--	3,975.3 acres (6R)
Birds					
Black-crowned night-heron *Nycticorax*	2	--	5 Col	--	--
Great blue heron *Ardea herodias*	2	3 Col	6.9 acres (1) 8 Col	1.2 acres (2) 11 Col	294 acres (3) 9 Col
Great egret *Ardea alba*	2	--	--	1 Col	1 Col
Band-tailed pigeon *Columba fasciata*	3	--	--	363.6 acres (1M 1R)	147.9 acres (1R)
Caspian tern *Sterna caspia*	2	1.1 acres (1)	1 Col	--	246.4 acres (1) 1 N
Chukar (nonnative) *Alectoris chukar*	3	--	--	841.6 acres (1R)	--
Double-crested cormorant *Phalacrocorax auritus*	2	--	--	--	246.4 acres (1B)

Table 3.5-6. Priority Wildlife and Vulnerable Aggregations within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Group Type or Common and *Scientific Name*	PHS Listing Criterion[a]	Occurrences within Corridors[b]			
		Rail	Rail-Columbia River	Central Return – Stampede Pass	Vessel
Forster's tern *Sterna forsteri*	2	--	1 Col	--	--
Osprey *Pandion haliatus*	3	39 N	33 N	25 N	43 N
Prairie falcon *Falco mexicanus*	3	2, 16 N	14 N	16 N	--
Ring-necked pheasant (nonnative) *Phasianus colchicus*	3	1,176.2 acres (1R)	1,058.7 acres (2R)	--	--
Tundra swan *Cygnus columbianus*	2, 3	58.6 acres (1R)	58.6 acres (1R)	5.4 acres (1R)	--
Wild turkey (nonnative) *Meleagris gallopavo*	3	1	1	2	--
Wood duck *Aix sponsa*	3	302.9 acre (1B)	13.4 acre (1B)	1,512.3 acre (9B)	--
Mammal Aggregations					
Roosting concentrations (breeding areas and communal roosts) of big-brown bat (*Eptesicus fuscus*), myotis bats (*Myotis* spp.), pallid bat (*Antrozous pallidus*)	2	23	20	38	--
Mammals					
Bighorn sheep *Ovis canadensis*	3	--	--	2,202.5 acres (4B) 7,981.0 (2R)	--
Columbian black-tailed deer *Odocoileus hemionus columbianus*	3	554 acres (1R)	177.7 acres (1R)	--	--
Elk *Cervus elaphus*	3	3.2 acres (1R)	--	46,735.7 acres (10R)	--
Elk – Roosevelt *Cervus elaphus*	3	--	--	1,361.8 acres (1R)	9,636.2 acres (1R)
Northwest white-tailed deer *Odocoileus virginianus ochrourus*	3	1,286.5 acres (2R)	--	--	--

Table 3.5-6. Priority Wildlife and Vulnerable Aggregations within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Group Type or Common and *Scientific Name*	PHS Listing Criterion[a]	Occurrences within Corridors[b]			
		Rail	Rail-Columbia River	Central Return – Stampede Pass	Vessel
Rocky Mountain mule deer *Odocoileus hemionus*	3	8,417.3 acres (7R)	3,375.2 acres (6R)	8,873.1 acres (5R)	--

Sources: BergerABAM (2014b), WDFW (2008)

Notes:

a A species is identified as a priority species based on the following criteria: vulnerable wildlife aggregations (Criteria 2) and wildlife of recreational, commercial, or tribal importance (Criteria 3)

b Occurrences are repeated within each corridor where corridors overlap. N = Nest; C = Concentration; Col = Colony; Concentrations – acres with number in parentheses, B = Breeding, M = Migration, R = Regular

Table 3.5-7. Special-Status Wildlife within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Common Name	Scientific Name	Federal	State	Occurrences within Corridors[a]			
		ESA/Special Status Species Status[b]	WA/OR Status[c]	Rail Corridor	Rail-Columbia River	Central Return – Stampede Pass	Vessel
Insects							
Beller's ground beetle	*Agonum belleri*	None/None	W-SC/None	--	--	2	--
Mardon skipper	*Polites mardon*	FC/SEN	W-SE/None	--	--	2	--
Puget blue	*Plebejus icarioides blackmorei*	None/None	W-SC/None	--	--	1	--
Taylor's checkerspot	*Euphydryas editha taylori*	FC/SEN	W-SE/None	--	--	3	--
Valley silverspot	*Speyeria zerene bremnerii*	None/None	W-SC/None	--	--	4	--
Amphibians							
Cascade torrent salamander	*Rhyacotriton cascadae*	None/WA-SEN	W-SC/O-SSv	1	--	--	--
Columbia spotted frog	*Rana luteiventris*	None/OR-SEN	W-SC/O-SSc	--	--	1	--
Dunn's salamander	*Plethodon dunni*	None/None	W-SC/None	--	--	2	3
Larch Mountain salamander	*Plethodon larselli*	FSC/SEN	W-SS/O-SSv	26	19	--	--
Rocky Mountain tailed frog	*Ascaphus montanus*	None/SEN	W-SC/O-SSv	--	--	3	--
Western toad	*Bufo boreas*	FSC/None	W-SC/O-SSv	2	1	1	--
Reptiles							
California mountain kingsnake	*Lampropeltis zonata*	None/WA-SEN	W-SC/O-SSv	18	9	--	--
Pacific pond turtle (Western pond turtle)	*Actinemys marmorata*	FSC/SEN	W-SE/O-SSc	18	11	1	--
Sagebrush lizard	*Sceloporus graciosus*	FSC/None	W-SC/O-SSv	9	7	--	--
Sharptail snake	*Contia tenuis*	FSC/None	W-SC/None	--	--	7	--
Birds							
American white pelican	*Pelecanus erythrorhynchos*	None/SEN	W-SE/O-SSv	4 C	2 Col, 1 C	1 C	--
Bald eagle	*Haliaeetus leucocephalus*	FSC/SEN	W-ST/None	12 N, 5 C	17 N, 1 C	28 N, 2 C	128 N, 7C
Brandt's cormorant	*Phalacrocorax penicillatus*	None/None	W-SC/None	--	--	--	1 Col

Table 3.5-7. Special-Status Wildlife within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Common Name	Scientific Name	Federal	State	Occurrences within Corridors[a]			
		ESA/Special Status Species Status[b]	WA/OR Status[c]	Rail Corridor	Rail-Columbia River	Central Return – Stampede Pass	Vessel
Burrowing owl	*Athene cunicularia*	FSC/WA-SEN	W-SC/O-SSv	14 N, 6 C	--	12 N, 1 C	--
Columbian sharp-tailed grouse	*Tympanuchus phasianellus*	FSC/WA-SEN	W-ST/O-SSc	1	--	--	--
Common loon	*Gavia immer*	None/WA-SEN	W-SS/None	--	--	1 N	--
Ferruginous hawk	*Buteo regalis*	FSC/WA-SEN	W-ST/O-SSc	1, 19 N	1 N	--	--
Flammulated owl	*Otus flammeolus*	None/None	W-SC/O-SSv	--	--	--	1
Golden eagle	*Aquila chrysaetos*	None/None	W-SC/None	4 N	2 N	2, 16 N	--
Greater sage-grouse	*Centrocercus urophasianus*	FC/WA-SEN	W-ST/O-SSv	--	--	2	--
Grasshopper sparrow	*Ammodramus savannarum*	None/OR-SEN	None/O-SSv	1 N	--	--	--
Harlequin duck	*Histrionicus*	None/SEN	None/None	--	--	3 C	--
Lewis' woodpecker	*Melanerpes lewis*	None/SEN	W-SC/O-SSc	2 N	2 N	1	--
Loggerhead shrike	*Lanius ludovicianus*	FSC/None	W-SC/O-SSv	1 N	--	--	--
Long-billed curlew	*Numeneus americanus*	None/WA-SEN	None/O-SSv	3	1	1	--
Marbled murrelet	*Brachyramphus marmoratus*	FT/None	W-ST/O-ST	--	--	4 OS, 23 AS	5 OS, 28 AS
Mountain quail	*Oreortyx pictus*	None/WA-SEN	None/O-SSv	3	1	1	--
Northern spotted owl	*Strix occidentalis*	FT/None	W-SE/O-ST	1 ST	1 ST	2 PT, 1ST	--
Oregon vesper sparrow	*Pooecetes gramineus affinis*	FSC/OR-SEN	W-SC/O-SSc	--	--	6, 25 N	--
Peregrine falcon	*Falco peregrinus*	FSC/SEN	W-SS/O-SSv	2, 20 N	2, 14 N	3 N	8 N
Pileated woodpecker	*Dryocopus pileatus*	None/None	W-SC/O-SSv	--	--	1 N	--
Purple martin	*Progne subis*	None/OR-SEN	W-SC/O-SSc	7 N, 2 Col	7 N, 4 Col	2 N, 4 Col	1 N, 2 Col
Sage thrasher	*Oreoscoptes montanus*	None/None	W-SC/None	3 N	--	--	--
Sagebrush sparrow	*Amphispiza nevadensis*	None/None	W-SC/None	1	--	--	--
Sandhill crane	*Grus canadensis*	None/WA-SEN	W-SE/O-SSv	--	--	10 C	1 C

Table 3.5-7. Special-Status Wildlife within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Common Name	Scientific Name	Federal	State	Occurrences within Corridors[a]			
		ESA/Special Status Species Status[b]	WA/OR Status[c]	Rail Corridor	Rail-Columbia River	Central Return – Stampede Pass	Vessel
Slender-billed white-breasted nuthatch	*Sitta carolinensis aculeata*	FSC/None	W-SC/O-SSv	1	2	--	--
Streaked horned lark	*Eremophila alpestris strigata*	FC/SEN	W-SE/O-SSc	--	--	--	4 N, 2 C
Swainson's hawk	*Buteo swainsonii*	None/None	None/O-SSv	7 N	--	--	--
Vaux's swift	*Chaetura vauxi*	None/None	W-SC/None	2	1	2	1 C
Western grebe	*Aechmophorus occidentalis*	None/None	W-SC/None	1 C	--	--	--
Mammals							
Black-tailed jackrabbit	*Lepus californicus*	None/WA-SEN	W-SC/O-SSv	2	3	7	--
California myotis	*Myotis californicus*	None/None	None/O-SSv	2	1	3	
Columbian white-tailed deer Columbia River Distinct Population Segment (DPS)	*Odocoileus virginianus leucurus*	FE/None	W-SE/O-SSv	--	--	1	8, 40 C
Fringed myotis	*Myotis thysanodes*	None/OR-SEN	None/O-SSv	--	--	3	--
Moose	*Alces americanus*	None/WA-SEN	None/None	1 C	--	--	--
Pallid bat	*Antrozous pallidus*	None/SEN	None/O-SSv	2	2	4	--
Pygmy rabbit	*Brachylagus idahoensis*	FE/None	W-SE/O-SSv	1 Col	1	--	--
Townsend's big-eared bat	*Corynorhinus townsendii*	FSC/SEN	W-SC/O-SSc	--	--	3	--
Townsend's ground squirrel	*Urocitellus* [*Spermophilus*] *townsendii*	None/WA-SEN	W-SC/None	4 Col	1 Col	5, 7 Col	--
Washington ground squirrel	*Urocitellus* [*Spermophilus*] *washingtoni*	FC/SEN	W-SC/O-SE	37 Col	--	--	--
Western gray squirrel	*Sciurus griseus*	FSC/WA-SEN	W-ST/O-SSv	4, 10 Col	2	1	--
Western pocket gopher	*Thomomys mazama*	FC/WA-SEN	W-ST/None	--	--	4, 11 C	--
White-tailed jackrabbit	*Lepus townsendii*	None/WA-SEN	W-SC/O-SSv	7	--	1	--
Wolverine	*Gulo*	FSC/SEN	W-SC/O-ST	--	1	--	--

Table 3.5-7. Special-Status Wildlife within the Rail, Rail-Columbia River, and Vessel Corridors in Washington

Common Name	Scientific Name	Federal	State	Occurrences within Corridors[a]			
		ESA/Special Status Species Status[b]	WA/OR Status[c]	Rail Corridor	Rail-Columbia River	Central Return – Stampede Pass	Vessel

Sources: USFWS (2015a), WDFW (2008), WDFW (2015b), USFS and BLM 2011

Notes:

a Occurrences are repeated within each corridor where corridors overlap; N = Nest; C = Concentration; Col = Colony; marbled murrelet – OS = number of observed sections, AS = number of adjacent sections; northern spotted owl – PT = number of pair territories, ST = number of single territories

b ESA Classifications: FE = federal endangered; FT = federal threatened; FSC = species of concern; FC = federal candidate; None = no federal ESA status/
USFS and BLM Special-Status Species Categories: SEN = Sensitive in Oregon or Washington; OR-SEN = Sensitive in Oregon only; WA-SEN = Sensitive in Washington only

c State Status: W = Washington; O = Oregon; SE = state endangered; ST = state threatened; SS = state sensitive; SC = state candidate, SSv = Oregon vulnerable, SSc = Oregon critical

Table 3.5-8. Wildlife Areas Managed for Biological Diversity and Multiple Use by Land Ownership and GAP Status Within the Rail Corridor in Idaho, Montana, and North Dakota

Protected Area Landownership or GAP Status[a]	Rail Corridor by State (acres)			Total (acres)
	Idaho	Montana	North Dakota	
Land Ownership				
Federal	3,306.7	66,654.1	329.8	70,290.6
State	2,811.8	18,859.1	789.4	22,460.2
Tribal	0	0	0	0
Local government	0.0	174.4	0.0	174.4
Private	0.0	137.5	0.0	137.5
Unknown	0.0	2,481.9	0.0	2,481.9
Total Protected Area[b]	6,118.5	88,307.0	1,119.2	95,544.7
Total Corridor Land Area	58,982.7	422,347.4	13,924.8	495,254.9
GAP Status				
GAP Status 1 Area	0.0	12,220.7	330.6	12,551.3
GAP Status 2 Area	628.0	6,247.4	788.6	7,664.0
GAP Status 3 Area	5,490.4	69,838.9	0.0	75,329.4
Total Protected Area	6,118.5	88,307.0	1,119.2	95,544.7
Total Corridor Land Area	58,982.7	422,347.4	13,924.8	495,254.9

Source: USGS (2012)

Notes:

a GAP Status: 1 = Managed for biodiversity – natural disturbances allowed, 2 = Managed for biodiversity – natural disturbances suppressed, 3 = Managed for multiple uses – majority of area maintained in natural cover

b Total Protected Area, defined as GAP Status 1, 2, or 3, is a subset of lands within the Total Land Corridor Area

Table 3.5-9. Special-Status Wildlife Potentially Occurring within the Rail Corridor in Idaho, Montana, and North Dakota

Common Name	Scientific Name	Status[a]	Idaho	Montana	North Dakota
Insects					
Dakota skipper	*Hesperia dacotae*	FT	--	--	X
Birds					
Greater sage-grouse	*Centrocercus urophasianus*	FC	--	X	X
Least tern	*Sterna antillarum*	FE	--	X	X
Piping plover	*Charadrius melodus*	FT	--	X	X
Red knot	*Calidris canutus rufa*	FT	--	X	X
Sprague's pipit	*Anthus spragueii*	FC	--	X	X
Whooping crane	*Grus americana*	FE	--	X	X

Table 3.5-9. Special-Status Wildlife Potentially Occurring within the Rail Corridor in Idaho, Montana, and North Dakota

Common Name	Scientific Name	Status[a]	Idaho	Montana	North Dakota
Yellow-billed cuckoo	*Coccyzus americanus*	FT	X	X	--
Mammals					
Black-footed ferret	*Mustela nigripes*	FE	--	X	X
Canada lynx	*Lynx canadensis*	FT	X	X	--
Grizzly bear	*Ursus arctos*	FT	X	X	--
Gray wolf	*Canis lupis*	FE	X[b]	X[b]	X
Northern long-eared bat	*Myotis septentrionalis*	FT	--	X	X
Woodland caribou	*Ragifer tarandus caribou*	FE	X	--	--

Sources: USFWS (2015a)

Notes:

a ESA Classifications: FE = federal endangered; FT = federal threatened; FC = federal candidate

b Gray wolf populations in Idaho and Montana were delisted due to recovery in 2011 (USFWS 2015b). Wolves in North Dakota are likely dispersing animals from Minnesota and Manitoba.

3.5.2.3 Vessel Corridor

The vessel corridor extends along the lower Columbia River between the Port and the Columbia River mouth and out to the 3-nmi boundary, passing through aquatic and terrestrial wildlife habitats within 0.25 mile from the shoreline. Washington and Oregon share their border at the Columbia River; the vessel corridor, although primarily open water (59 percent), is disproportionately split between Washington (36 percent) and Oregon (64 percent).

Wildlife Habitats

Shrublands and grasslands (16 percent) are the most abundant land cover along the vessel corridor followed by forests and woodlands (13 percent) and then agricultural and developed lands (11 percent). Within the shrublands and grasslands, the most common habitats are intertidal freshwater wetlands, coastal sand dune and strand, and freshwater mudflats.

Important wildlife habitats include lands managed for biological diversity (27.8 percent) and multiple uses (4.4 percent). Important wildlife habitats crossed by the vessel corridor include the Julia Butler Hansen Refuge for the Columbian White-Tailed Deer (4,153 acres), Lewis and Clark National Wildlife Refuge (13,914 acres), Ridgefield National Wildlife Refuge (865 acres), and Oregon Islands Wilderness (610 acres). WDFW Wildlife Areas crossed include Mount Saint Helens-Shillapoo (426 acres), Olympic-Willapa Hills-South Puget Sound (32 acres), and Sauvie Island (1,319 acres). Private natural areas include Blind Slough Swamp (155 acres), Puget Island Preserve (21 acres), Forestry Riparian Easements (66 acres), and the Wetland Reserve Program (91 acres).

Priority Habitats

Four priority habitats occur within the vessel corridor (Table 3.5-5). The most abundant priority habitat crossed by the vessel corridor is biodiversity areas and corridors (2.9 percent), followed by wetlands (2.0 percent) and cliffs or bluffs (0.9 percent; Table 3.5-5). Descriptions of these priority habitat types are provided in the rail corridor discussion above. The vessel corridor also contains less than 0.1 percent cave or cave-rich areas. Caves are naturally occurring cavities, recesses, voids, or systems of interconnected passages under the earth in soils, rock, ice, or other geologic features and are large enough to contain a person. Mine shafts may mimic caves (WDFW 2008). Caves are largely devoid of vegetation. They provide habitat for a variety of wildlife including maternity, hibernation, or roosting habitat for bats. Caves are impacted and disturbed by road construction, recreation (climbing), and mining (WDNR 2011a).

Priority Wildlife and Vulnerable Aggregations

Priority wildlife occurring within the vessel corridor are listed in Table 3.5-6. Vulnerable bird aggregations include breeding waterfowl, shorebirds, and seabirds during spring and summer, and migrating and wintering waterfowl and shorebirds. Game birds that occur within the vessel corridor include band-tailed pigeons. Fall and winter waterfowl aggregations are popular hunting areas. Game mammals that occur within the vessel corridor include Roosevelt elk (Table 3.5-6).

Special-Status Wildlife

Special-status wildlife documented within the vessel corridor include one amphibian, nine birds, and one mammal (Table 3.5-7). Special-status birds present in the vessel corridor that do not occur in the rail and rail-Columbia River corridors include Brandt's cormorant, marbled murrelet, flammulated owl, and streaked horned lark (Table 3.5-7). Special-status mammals present in the vessel corridor that do not occur in the rail and rail-Columbia River corridors include the Columbian white-tailed deer (Columbia River Distinct Population Segment [DPS]; Table 3.5-7).

3.5.3 Impact Assessment

3.5.3.1 Proposed Facility

Construction

Facility construction would permanently remove an estimated 1.1 acre of vegetation (1.0 acre of upland grass/forb patches and 0.1 acre of upland cottonwood stand) and would temporarily remove an estimated 3.5 acres of vegetation (upland grass/forb; Table 3.4-6). Removal of the upland grass/forbs in the Urban and Mixed Environs habitat would result in a small loss of forage habitat, primarily vegetation and seeds for small mammals and birds (Table 3.5-10). Removal of approximately nine black cottonwood trees in the Westside Lowland Conifer-Hardwood Forest habitat would result in a small loss of vegetation structure including tree canopy, shrub understory, and ground cover that could provide shelter, perching, and nesting or burrow sites for birds, squirrels, and small- to medium-sized mammals, as well as vegetation and insects for forage (Table 3.5-10). These small areas of habitat would likely be covered with impervious surfaces that largely have no value as wildlife habitat. To compensate for habitat loss, the Applicant would install approximately 2.2 acres of landscape plantings, which would provide habitat typical of urban areas. Considering the Applicant's intention to replace the nine black cottonwood trees removed during construction, and that the removal of approximately 9 trees is not a substantial amount, the impacts to forest habitat from proposed Facility construction would be minor.

Active bird nests could be lost when trees are cut and vegetation is cleared if they occur within trees or vegetation that is to be cleared.

Construction equipment and associated vehicles could run over amphibians, reptiles, and small mammals. Reptiles from the adjacent Vancouver Lake Wildlife Area may move onto roadways to bask, increasing their vulnerability to being run over by equipment and vehicles. Amphibians are less likely to venture onto gravel or paved roadways but may be encountered during vegetation clearing or equipment transits across vegetated habitats. Small mammals are vulnerable to being run over by vehicles as they move between habitats or when they are in burrows and their burrows can be destroyed. However, because most vehicles and equipment would be moving at slow speeds within the proposed Facility site and few animals would be likely to collide with vehicles, impacts to amphibians, reptiles, and small mammals from operation of construction equipment and vehicles would be minor.

Table 3.5-10. Summary of Wildlife Habitat Acreage Impacts

Habitat Type	Unloading and Office Area (Area 200)	Storage Area (Area 300)	Marine Terminal (Area 400)	Transfer Pipelines (Area 500)	Boiler Building (Area 600)	Rail Improvements	Permanent Impacts	Temporary Impacts
Urban/Mixed Environs	7.8	20.9	2.8	4.9	0.8	5.4	42.6[a]	57.1
Westside Riparian-Wetlands	0.0	0.0	0.0[b]	0.0	0.0	0.0	0.0	0.0
Westside Lowland Conifer-Hardwood Forest	0.0	0.0	0.0	0.1[c]	0.0	0.0	0.1	0.0
Agricultural, Pasture, and Mixed Environs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Acreage	7.8	20.9	2.8	5.0	0.8	5.4	42.7	57.1

Source: BergerABAM (2014b)

Notes:

a Approximately 1.0 acre of Ruderal Upland Grass/Forb would be converted to developed uses within this habitat type.

b Facility elements would be constructed in an area with scarce vegetation. No high-quality vegetation would be removed or existing riparian habitat function negatively affected.

c A total of 1.7 acres of impacts to upland cottonwood stand include impacts from the CPU substation permitted separately.

Noise generated during construction would result from ground clearing, excavation foundation installation, building erection and finishing, and vibratory and impact pile driving. Ambient sound levels near the proposed Facility site are on the order of 60 dBA (A-weighted decibel) day-night sound levels (Table 3.9-8). Combined construction equipment day-night sound levels would range from 80.2 to 89.6 dBA 50 feet from the activity (Table 3.9-9), which would attenuate to near background levels within 3,000 feet. Noise from pile driving would be on the order of 93 dBA day-night levels at 50 feet from the activity (Table 3.9-11), which would also attenuate to near background levels within 3,000 feet. Construction would occur during daylight hours unless ground improvement work must occur at night to comply with the recommended WDFW in-water work window (see Section 3.6). The intermittent nature of loud construction noises may make this type of noise more disturbing to wildlife.

Noise caused or generated by humans may have variable effects on wildlife at the proposed Facility and in the surrounding area, including changes in temporal patterns, changes in distribution and movement, decreases in foraging, increases in vigilance and antipredator behavior, changes in mating behavior and territorial defense, and temporary or permanent hearing loss (FHWA 2004, Radle 2007, Kight and Swaddle 2011, Francis and Barber 2013). Chronic and frequent noise can interfere with an animal's ability to detect important sounds, while periodic, unpredictable noises can be interpreted as threatening (Francis and Barber 2013). Animals use sound for communication, navigation, avoiding danger, and finding food. Increased background noise can interfere with these important signals, and studies have found that many different animals change the frequency, rate, and timing of vocal signals in response to human-generated noise (FHWA 2004). If noise becomes a constant stressor, it can reduce reproductive success and long-term survival (FHWA 2004, Radle 2007).

Noise generated during construction could reach wildlife habitats within a 2-mile radius that includes the CRWMB and the Vancouver Lake Wildlife Area. These areas are used by a variety of waterfowl, raptors, migratory birds, small mammals, amphibians, and reptiles, and also provide potentially suitable habitat for a number of special-status wildlife species. Nesting birds would likely be most disturbed, but staging and wintering waterfowl may also be susceptible, especially to intermittent loud noises. Nesting birds may abandon nests, and disturbance to staging birds can include displacement away from typically used stopover locations.

The Applicant calculated that terrestrial noise associated with impact pile driving will attenuate below 90 dB within approximately 900 feet. Therefore, the Applicant proposes to avoid and minimize noise disturbance impacts to wildlife during construction by measuring noise levels in the monitoring zone, which has been established for areas within 900 feet of the unloading and office area (Area 200), ground improvements at the storage area and marine terminal (Areas 300 and 400), and upland piles at the marine terminal (Area 400) (BergerABAM 2015).

A threshold of 90 dB and 900 feet may not be adequate for monitoring noise impacts to wildlife. Therefore, noise disturbance impacts to wildlife during construction could be minor to moderate. EFSEC has identified mitigation measures in Section 3.5.5 for identifying and implementing appropriate noise level thresholds, monitoring distances, and adaptive management actions to reduce noise impacts to minor levels.

Wildlife could be exposed to small leaks of fuel, oil, and lubricants from construction equipment. Such small leaks would not likely reach water, and amphibians would not likely be affected. Small mammals and birds are not likely to be exposed to small fuel or oil spills, although a few individual mice or passerines could be exposed, leading to mortality through hypothermia or from toxic effects during grooming, preening, or ingestion of contaminated food or water. However, because BMPs identified in the SPCC Plan would be put in place to reduce these effects, including regular monitoring and inspections of equipment for leaks, impacts to wildlife from small spills and leaks would be minor.

Operation and Maintenance

No additional loss of wildlife habitat would occur during operation and maintenance of the proposed Facility. Disturbance to wildlife from operations within and around the proposed Facility could result from noise generated by equipment used at the proposed Facility and from the addition of outdoor lighting.

Operational noise modeled for analysis includes noise generated by the compressor and transformer from railcar unloading (Area 200); pumps and transformers from the storage tanks (Area 300); blowers and exhaust from the marine terminal (Area 400); and locomotives, railcars, switch engines, and horns from trains (Table 3.9-14). Train horns emit a sound between 96 and 100 dBA at 100 feet (see Section 3.9). Day and night operational noise in areas identified as waterfowl migration and winter habitat northwest of the proposed Facility site (areas surrounding noise receptor R5 – NW Residence in Table 3.9-16) was modeled at 36 dBA, which is below the ambient measured level of 60 dBA for this location (Table 3.9-16). Operational noise for the receptors nearest the Vancouver Lake Wildlife Area (noise receptor R3 – Tidewater, and R4 – CPU) were modeled at 52 and 61 dBA hourly levels, respectively (Table 3.9-15), which are below the ambient levels at these locations. Wildlife using habitats near existing Port operations are not likely to be displaced by new noises from operations because any increases would be within ambient conditions. Therefore, impacts to wildlife from noise generated at the proposed Facility during operation and maintenance activities would be minor.

New lights would be installed on administrative and support buildings (Area 200), storage tanks (Area 300), and at the marine terminal (Area 400). Lighting would include low-level lights around exits (minimum 2-foot candles) and general outdoor lighting (from 0.2- to 5-foot candles) for operating areas for access and safety under regular operating conditions. Extra spot lighting would be provided around loading equipment maintenance areas and stairwells and catwalks and would assist in visual detection of oil leaks. Light and glare can reach adjacent wildlife habitats reducing nocturnal habitat suitability. Artificial lighting can alter behavior, foraging areas, and breeding cycles of insects, turtles, birds, and other wildlife (Longcore and Rich 2004). Frogs have been found to stop mating calls when they are exposed to excessive light at night, which can reduce their reproductive capacity (Longcore and Rich 2004). Feeding behavior of bats can be focused on insects attracted by artificial lights (Longcore and Rich 2004, Chepesiuk 2009). Artificial lights are currently in use in areas of the Port and lighting for the proposed Facility site is not expected to extend into adjacent wildlife habitats such as the CRWMB or the Vancouver Lake Wildlife Area. To minimize impacts of exterior lighting to wildlife, the Applicant has committed to design directional Facility lighting that would be aimed away from sensitive habitats to the extent practicable. Overall, impacts to wildlife from light and glare at the proposed Facility would be minor.

Existing impervious surfaces and roads likely inhibit movements of reptiles and amphibians between the wetlands and the river (Jackson 2000). The berm surrounding the tanks in the storage area (Area 300) that borders wetlands surrounding this area to the north and east may be attractive to reptiles for basking. Reptiles, amphibians, and small mammals accessing and crossing the berm may become trapped inside the containment berm. These impacts, however, are expected to be minor.

Impacts to wildlife could result from untreated stormwater runoff or inadvertent releases of small amounts of hazardous materials (e.g., fuels, lubricants) from operational equipment and vehicles. Untreated stormwater runoff could carry oil into surrounding habitats and would reduce habitat quality, which could increase the potential for wildlife to be exposed to oil and other hazardous chemicals. Inadvertent releases of small amounts of hazardous materials could result in loss of a few individual animals, but would be expected to be contained within the Facility's boundaries. However, because BMPs identified in the SWPPP would be put in place to reduce these effects, impacts to wildlife from untreated stormwater and small spills and leaks would be minor.

Potential Problem Wildlife Issues

Both native and invasive wildlife that are adapted to urban and industrial areas and human activity have the potential to create problems for the proposed Facility (WDFW 2004) as discussed herein.

Bats. Bats often use human-made structures for roosting and hibernation. Some bats seem to prefer human-made structures to natural roosts. Bats may be forced to roost in buildings when natural roosts, such as caves and hollow trees, are destroyed. In spring and fall, migrating bats may temporarily roost outside on window screens, fence posts, piles of lumber, and other unlikely places (WDFW 2004). The administrative and support buildings (Area 200) that would be constructed as part of the proposed Facility could provide additional roosting and hibernation habitat for bats. The railcar unloading facility (Area 200) would create potential roosting habitats under the roofs within the rafters. Bats would likely be attracted to the areas with outdoor lights installed to forage on insects drawn to the lights.

Coyotes. Coyotes are highly adaptable and opportunistically forage by hunting and scavenging. In Washington coyotes occupy every habitat type, including densely populated urban areas. In developed areas, coyotes are attracted by garbage, pet food, garden crops, and pets (WDFW 2004). Facility operation would create garbage onsite. Although coyotes would most likely avoid the area during the day when humans would be working at the proposed Facility, they may be attracted to garbage left uncontained onsite at dusk, dawn, and nighttime, when less human activity occurs and when coyotes are naturally more active.

Raccoons. Raccoons live in various habitats throughout Washington. In urban areas, they rely primarily on handouts, pet food, and garbage for nutrition. Raccoons naturally use abandoned burrows dug by other mammals, areas in or under large rock piles and brush piles, hollow logs, and holes in trees as den sites. In urban areas raccoons have adapted to denning in attics, crawl spaces, chimneys, and abandoned vehicles (WDFW 2004). Raccoons are nocturnal and, like coyotes, could also be attracted to the proposed Facility site at night by uncontained garbage created during operation. Raccoons could also use structures built for the proposed Facility as den sites.

Opossums. Opossums have adapted to living in close proximity to humans in urban and suburban environments. They inhabit most human-occupied habitats in western Washington. In developed areas, opossums forage on garbage, pet food, birdseed, poultry, and handouts. Opossums use a variety of den sites including burrows dug by other mammals, rock crevices, hollow stumps, logs and trees, woodpiles, and spaces in or under buildings (WDFW 2004). Like raccoons and coyotes, these nocturnal animals could be attracted to the proposed Facility site at night by uncontained garbage created during operation. They could also use structures built for the proposed Facility as den sites.

Skunks. Two types of skunks live in Washington: the striped skunk and the spotted skunk. Both skunks occur in open fields, pastures, croplands near brushy fencerows, rock outcroppings, brushy draws, and in some suburban and urban locations. The striped skunk is generally more tolerant of human activity and more likely to be found in developed areas. Skunk den sites include burrows, hollow trees, wood and rock piles, buildings, porches, concrete slabs, culverts, and drainpipes (WDFW 2004). Skunks could be attracted to the proposed Facility site at night by uncontained garbage created during operation. They could also use structures built for the proposed Facility as den sites.

Rats. Rats are found throughout developed habitats in Washington. Rats eat seeds, nuts, insects, young birds and bird eggs, food scraps, and garbage. They build nests in buildings, trees, and overgrown shrubbery or vines. In buildings, they can often be found in attics and walls, or in burrows at the base of building foundations (WDFW 2004). Rats could be attracted to uncontained garbage created during Facility operation. They could also use structures built for the proposed Facility as nest sites.

Crows. Crows are highly adaptable and will occupy almost any woodland, farmland, orchard, or urban habitat as long as sufficient shelter and nesting habitat are available. Crows are omnivorous and will scavenge dead animals and garbage. Crows typically nest in tall trees, but in urban areas they may nest on window ledges or the sides of buildings (WDFW 2004). Crows could also be attracted to uncontained garbage at the proposed Facility. They could also use structures built for the proposed Facility as nesting and roosting sites.

Starlings. European starlings are an invasive species that occupy a variety of developed habitats in low elevations throughout Washington. Starlings eat insects, fruit, seeds, and food scraps. They forage on lawns and other areas of short grass, such as pastures, golf courses, and turf farms. They nest in suitable holes and crevices in buildings, utility poles, decaying trees, and holes in cliff faces (WDFW 2004). Starlings could be attracted to garbage created during operation that is not appropriately contained. They could also use structures built for the proposed Facility as nesting and roosting sites.

Pigeons. Rock pigeons (also called the rock dove or city pigeon) originated in Europe, Northern Africa, and India. Since introduced to the eastern United States in the 1600s, rock pigeons have spread throughout North America, where they have adapted to roosting and nesting on windowsills, roofs, eaves, steeples, and other human-made structures. Rock pigeons eat seeds, grains, insects, fruit, and vegetation, and scavenge human food (WDFW 2004). Garbage, food scraps, and artificial roosting and nesting structures could attract rock pigeons to the proposed Facility site.

Swallows. Seven species of swallows breed in Washington. Two, the barn swallow and the cliff swallow, regularly build mud nests on human-made structures. Barn swallows almost always build nests on eaves, bridges, docks, or other human-made structures. Cliff swallows build their nests on vertical walls, natural or human made, usually with some sort of sheltering overhang. Freeway overpasses, bridges, barns, and other large buildings are regularly used for nesting. Swallows are insectivores, but barn swallows will also eat some berries and seeds (WDFW 2004). Foraging habitats for swallows are abundant over the wetlands and river near the proposed Facility site, and swallows could be attracted to new structures for nesting.

Gulls. Gulls that would likely occur at the proposed Facility site include herring gulls and California gulls. Gulls are opportunistic feeders and will eat fish, insects, earthworms, small mammals, grains, fruit, invertebrates, and garbage (Cornell Lab of Ornithology 2015). Gulls could be attracted to uncontained garbage and food scraps during Facility operation. Foraging habitats for gulls are abundant over the wetlands and river near the proposed Facility site, and gulls could be attracted to structures for roosting.

Methods for deterring roosting and nesting of birds and bats could be chemical (e.g., repellents, toxicants, fumigants), coatings (e.g., gels, slick surfaces), physical (e.g., spikes, wires, slides, curtains), removal (e.g., trapping, shooting, predator hunting of birds and removal of nests, eggs, food), and scaring (e.g., noise, static figures, moving figures). In addition to these methods, modification of structures through design can eliminate nesting and roosting sites (Tate 2010). The most effective deterrent methods are physical modifications, including modified structure design and addition of spikes or wires, because these methods have the greatest longevity, require the least maintenance, and when properly installed and maintained are effective (Tate 2010). Design modifications include enclosing the structural components such that no horizontal top surfaces remain accessible, screening openings to prevent access to sheltered spaces that would be preferred for nesting or roosting, and installing spikes or wires on surfaces that could be used for perching or roosting. Suggested mitigation measures to address potential nuisance wildlife at the proposed Facility are provided in Section 3.5.5 below.

Mammals including coyote, raccoon, and opossum and birds are attracted to garbage that is not securely contained, including food scraps left on the ground or in the backs of pickup trucks from workers eating outside. To avoid attracting birds and mammals, workers should dispose of all garbage in appropriately secured containers.

Decommissioning

Decommissioning would include removal of buildings and tanks constructed for the proposed Facility. Decommissioning would have some impacts similar to construction including collision mortality, noise disturbance, and inadvertent releases of small amounts of fuels and lubricants from decommissioning equipment. Impacts to adjacent wildlife habitats could include sediment runoff and potential releases of toxic materials bound within caps that are disturbed.

Construction and operation of the proposed Facility is expected to have minor impacts to terrestrial wildlife because the habitat that would be permanently or temporarily impacted is primarily unvegetated industrial area, construction noise impacts to wildlife in surrounding areas would be minimized through noise monitoring and adaptive management, and the proposed Facility site does not contain special-status wildlife. Decommissioning is likely to also have minor impacts to terrestrial wildlife.

3.5.3.2 Rail Transportation

Linear transportation features, such as railways, can affect wildlife through habitat loss, habitat fragmentation, and direct mortality from collisions. Wildlife impacts related to habitat fragmentation include barrier effects, creation of habitat edges, reductions in core habitat areas, facilitation of predator movements, intrusion of invasive plants and animals, and intrusion of humans (Jalkotzy et al. 1997).

Wildlife in Washington

The rail corridor within Washington crosses through many habitat types from lowland riparian forests to montane forest and sagebrush prairie and steppe, creating different potential interactions between wildlife and trains. The proposed Project would use existing rail infrastructure and no additional loss of habitat would occur. Unit trains that deliver crude oil to the proposed Facility and return would incrementally increase train traffic (Table 3.5-11) and associated disturbance within the rail corridors, which could increase barrier effects and wildlife collision mortality (Dorsey 2011).

Table 3.5-11. Summary of Project-Related Increases in Rail Traffic

Segment[a]	Track Miles	Number of Trains/Day			Number of Trains/Hour[b]			Change %
		Passenger	Freight	Project	Current	Project	Total	
Sandpoint-Spokane	65.5	2	46	8	2.00	0.33	2.33	17%
Spokane-Pasco	149	2	30	8	1.33	0.33	1.67	25%
Pasco-Vancouver	227	2	26	4	1.17	0.17	1.33	14%
Vancouver-Tacoma	137	10	31	4	1.71	0.17	1.88	10%
Tacoma-Auburn	20	28	13	4	1.71	0.17	1.88	10%
Auburn-Pasco	227	0	6	4	0.25	0.17	0.42	67%

Source: WSDOT (2014)

Notes:

a Assumes return trains all use the Central Return - Stampede Pass Alignment.

b Assumes 24-hour train operation.

Railways can create almost impassable barriers for reptiles, amphibians, and small mammals (Jackson 2000). They can function as complete or partial barriers to wildlife movement, preventing or delaying access to important habitats, or they may facilitate wildlife movements, increasing the risk of being struck by trains (Dorsey 2011). The four unit trains per day that would deliver crude oil to the proposed Facility would add eight train trips daily to the system (four delivery and four return trips). For this analysis each train is assumed to have an approximate 5-minute crossing time (see Section 3.14).

Overall, the proposed Project could result in an additional 21-minute period during a day when trains may block wildlife movement at any given point based on a constant speed of about 20 mph (see Section 3.14). The Washington State Rail Plan provides current use levels (trains per day) for route segments for passenger and freight use (Table 3.5-11; WSDOT 2014). Combined, Project-related and current rail traffic would be busiest between Spokane and Sandpoint, Idaho, with an average of 2.3 trains/hour, and the quietest route segment would be on the Central Return - Stampede Pass return route between Auburn and Pasco, with an average of 0.4 trains/hour based on 24-hour operations (Table 3.5-11). Increases in traffic volumes would be greatest for the Auburn-Pasco and Spokane-Pasco segments.

Train collision mortality rates for wildlife are affected by wildlife attributes that include abundance, behavior, and foraging, and railway attributes that include alignment, design, and traffic volume (Dorsey 2011). Wildlife mortality estimates for trains are often minimum values because collisions can occur in remote locations, go undetected or unreported by engineers, and scavengers can remove carcasses before they are found (Dorsey 2011). Wildlife mortality from collisions with trains can be substantial and sufficient to affect management of wildlife populations (Myers et al. 2008, Dorsey 2011).

The wildlife most likely to be affected by additional trains traveling through the rail corridor would be deer, elk, and bears. Long-term studies of train collision mortality along the Canadian Pacific Railroad through Banff and Yoho National Parks found that an average of 19 trains per day traveling at an average speed of 37 mph over 82 miles of track resulted in annual strike rates of 27.6/year for elk, 8.8 year for deer, and 3.3/year for black bear (Dorsey 2011). Proximity of rail and highway corridors, while minimizing overall habitat fragmentation, may increase the level of rail collision mortality as animals avoiding highway traffic may increase use of the rail corridor, resulting in increased rail collision mortality (Dorsey 2011). Important variables for predicting deer and elk strikes include their abundance, train speed, ROW widths, barriers, and bridges (Dorsey 2011). Deer and elk strike locations were generally associated with areas of higher relative abundance (Dorsey 2011).

Predicted locations for high levels of deer and elk collision mortality may be similar to highway high-level mortality locations (Myers et al. 2008), and likely areas for elevated collision mortality may be identified by locating habitat concentration areas and movement corridors between these areas (Washington Wildlife Habitat Connectivity Working Group 2010). Along the rail corridor, high levels of deer and elk highway collision mortality appear to occur in three locations between Spokane and the Port (one on the Spokane-Pasco segment and two on the Pasco-Vancouver segment) and in four locations along the Central Return - Stampede Pass Alignment (one on the Vancouver-Tacoma segment, two on the Auburn-Pasco segment, and one on the Pasco-Spokane segment; Myers et al. 2008). The incremental increase in estimated Project-related rail traffic (Table 3.5-11) would likely contribute to a minor to moderate increase in wildlife collision mortality. In addition, predators and scavengers such as wolves, coyotes, foxes, ravens, and magpies may be attracted to the rail corridor by the increased availability of carcasses from animals hit by trains, which could lead to a minor to moderate increase in collisions with these species as well.

Wildlife habitats within the rail corridor could be affected by leaks of small quantities of grease, oil, and fuel along the railways. These small spills and leaks would be expected to generally remain on the railbed and are not likely to reach vegetated habitats. Some wildlife could be exposed to low levels of hydrocarbons from leaks and small spills. While most contamination would remain within the railbed, precipitation may transport some contaminates into nearby waters where they may result in reduced productivity and potential increases in deformities in amphibians. Reptiles such as snakes and lizards may be exposed to contaminants if they use the railbed for basking. The rail corridor is currently used by passenger and commodity train traffic, including crude oil train traffic, and detecting differences from current conditions attributable to the proposed Project would not likely be possible. However, impact levels from these contaminants would be expected to be minor.

Wildlife in Idaho, Montana, and North Dakota

Wildlife issues for the rail corridor through Idaho, Montana, and North Dakota would be similar to the issues in Washington. Of note would be the increase in rail traffic through Glacier National Park (Wells et al. 1999) and potential increase in collision mortality for federally protected grizzly bears. Predators, including bald and golden eagles, wolves, and wolverines, also increase their risk for collision mortality by scavenging on train-killed deer, elk, and moose especially during fall and winter (Wells et al. 1999). The incremental increases in rail traffic resulting from the Proposed Action could contribute to minor to moderate long-term impacts to terrestrial wildlife from incremental increases in barrier effects, collision mortality, and minor increases of small quantities of contaminants.

3.5.3.3 Vessel Transportation

Wildlife within the vessel corridor could be affected by shoreline erosion from incremental increases in wake effects, wake and vessel disturbance, and injury or mortality from vessel strikes. Wildlife that use shoreline habitats, including amphibians, small mammals, and shorebirds, could experience some shoreline erosion and periodic disturbance as vessel wakes collide with the shoreline. Wake-induced shoreline erosion could result in some habitat alteration. The degree of shoreline erosion would be subject to shoreline substrate and vegetation cover, shoreline exposure, and the size, draft, and speed of the vessel producing the wake.

Waterfowl and seabirds using open-water habitats are the most likely to be disturbed by vessel traffic. Priority aggregations of waterfowl and seabirds that could be disturbed within the vessel corridor include breeding and nonbreeding terns, grebes, loons, cormorants, phalaropes, mergansers, bufflehead, goldeneyes, ducks, geese, and swans (Table 3.5-6). Priority birds present in the vessel corridor that may be susceptible to vessel disturbance include Caspian terns and double-crested cormorants. Special-status waterbirds present in the vessel corridor that may be susceptible to vessel disturbance include bald eagles, Brandt’s cormorant, marbled murrelet, and sandhill cranes (Table 3.5-7). Waterfowl and seabirds also occasionally collide with vessels both when in motion and at anchorage. Collisions are most likely to occur at night or during periods of poor visibility and poor weather, when birds may be attracted by vessel lights. Although disturbance to these birds may occur, vessels associated with the proposed Facility would transit through the vessel corridor within designated shipping lanes, and waterfowl and seabirds using the area would be habituated to existing and routine vessel traffic. Therefore, impacts to waterfowl and seabirds from vessel transportation related to the proposed Facility would be expected to be minor.

Terrestrial wildlife would not generally be affected by vessel traffic along the river. Occasionally, large and small mammals swim across the river and could be hit by vessels, but this would likely be a rare event. Overall, impacts to terrestrial wildlife from vessel traffic would be minor.

3.5.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant’s request to construct and operate the proposed Project at the Port, and the following impacts to terrestrial wildlife from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue. Wildlife habitats would continue to be affected by neighboring industrial activity. The risk of contamination from fuels, lubricants, and oils would be reduced and the impervious surfaces would continue to be inhospitable to use by native wildlife. Approximately 246 cottonwood trees would be removed for construction of a CPU substation, which would reduce wildlife habitat in this area.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Construction under the No Action Alternative for these alternative uses would likely have similar wildlife impacts to the Proposed Action, with conversion of limited habitat areas to industrial use, collision mortality, noise disturbance from equipment, and small spills or leaks of fuels or oil. Approximately 246 cottonwood trees would be removed for construction of a CPU substation, which would reduce wildlife habitat in this area. Operation of these alternative uses could modify wildlife effects with different impacts depending on the use—for example, an increased risk of attraction of nuisance wildlife would likely occur with grain operations.

3.5.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to terrestrial wildlife in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce impacts to terrestrial wildlife:

- Incorporate LED bulbs that fall within optimum wavelengths in area lighting to reduce light pollution impacts where practicable and within safety regulations.
- Only use marine terminal loading area spot lighting during loading operations.
- Finalize the Construction Wildlife Monitoring Plan in consultation with EFSEC and WDFW and implement all recommended measures to reduce impacts to wildlife including development of final noise threshold levels, monitoring distances, and adaptive management actions.
- Measure noise levels during construction in the unloading and office area, the storage area, and the marine terminal (Areas 200, 300, and 400, respectively) including impact pile driving and ground improvement installation. If measured noise levels at the established distances exceed the established threshold, perform adaptive management actions, which could include additional noise monitoring at the nearest sensitive resource, using noise dampening strategies for impact pile driving such as placing nylon or wood blocks between the pile and hammer, and using temporary sound barriers such as containers, earthen berms, or stockpiled materials around the ground improvement area.
- Retain old wood pilings, or check wood pilings for cavities used by purple martins before removing them. The removal of creosote-coated pilings that contain purple martin nest boxes or cavities used by martins should be coordinated closely with WDFW.
- Perform tree removal outside of the nesting season (February 15 to September 1) to avoid potential impacts to active nests of protected migratory birds. If trees are to be removed during the nesting season, complete a preconstruction nesting survey no more than 2 weeks prior to removal to ensure that no active nests are present. If active nests of protected migratory birds are found, suspend tree removal activities until after nests have hatched and young have fledged.
- Monitor the approximate 2.2 acres of landscape plantings for 2 years after planting and replace all trees that do not become successfully established.
- Incorporate design features such as enclosing structures so that no horizontal top surfaces are accessible, screen openings to prevent access to enclosed spaces for roosting or nesting, and install spikes or wires to prevent perching to avoid attracting birds such as pigeons, gulls, and starlings the proposed Facility.
- Include measures in the waste management plan to control and contain food waste, and educate workers on the risk to native wildlife from supplemental feeding and the importance of disposing of all garbage in secured containers to prevent supplemental feeding of wildlife.

EFSEC also recommends that BNSF identify and monitor wildlife-train collision and barrier hotspots along the rail corridor to determine whether current and projected levels of traffic would result in levels of mortality or barrier effects that would jeopardize the status of local wildlife populations. If significant levels of collision mortality and barriers to wildlife movement are identified, suitable wildlife crossing structures and other measures, such as fencing should be considered as appropriate. BNSF should consult with WDFW and USFWS or a Technical Advisory Committee in designing approaches to identify and monitor hotspots and in identifying suitable crossing structures and other measures.

3.5.6 Significant Unavoidable Adverse Impacts

The incremental increase in Project-related rail traffic would likely contribute a minor to moderate increase in wildlife collision mortality, including to predators and scavengers that may be attracted to the rail corridor by the increased availability of carcasses from animals hit by trains.

The incremental increases in Project-related rail traffic could contribute to minor to moderate long-term impacts to terrestrial wildlife from incremental increases in barrier effects and minor increases of small quantities of contaminants.

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3.6 AQUATIC SPECIES

This section describes the existing aquatic species at and near the proposed Facility at the Port and along rail and vessel transportation corridors that would be used to transport crude oil to and from the proposed Facility. The affected environment described for aquatic species includes areas that would experience direct and/or indirect effects from the proposed Facility and associated rail and vessel transportation, including areas potentially affected by a crude oil spill, fire, or explosion. Impacts to aquatic species from an oil spill, fire, or explosion are discussed in Chapter 4. Descriptions of impacts to common aquatic species and threatened, endangered, or sensitive aquatic species from construction, operation and maintenance, and decommissioning of the proposed Facility, along with impacts from normal rail and vessel operations are provided herein. The Applicant completed a separate BE, covering species or critical habitats potentially affected by the Project that are protected under the ESA and essential fish habitat (EFH) protected under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The BE was developed as part of an application for US Department of the Army authorization under CWA Section 404 and Rivers and Harbors Act Section 10 to define impacts to ESA-listed species from the Proposed Action. Information from the BE has been incorporated into this section.

3.6.1 Methods of Analysis

The analysis of impacts to aquatic species considered impacts from Facility construction, including loss or alteration of habitat from modifications to the marine terminal, temporary degradation of water quality, noise disturbance from construction equipment operation and pile-driving activities, and adverse effects from small spills or leaks of fuel, hydraulic fluids, or oil from construction equipment. The analysis also considered the potential for impacts during Facility operation, including noise and lighting impacts, propeller scour, entrainment[1] in vessel intakes, loss of habitat from the damaging effects of vessel wakes, impairment of access to and through shoreline habitat, and reductions in water quality from leaks of fuel, crude oil, ballast water, and other hazardous materials. The analysis of impact to aquatic species and habitat within the rail corridor included increased exposure to leaks of small quantities of grease, oil, and fuel along the railways. With the vessel corridor, impacts included increased noise and disturbance generated by vessels, habitat disturbance from vessel wakes, wake stranding of fish, reduced water quality, and vessel strikes.

The study areas used to describe the affected environment for aquatic resources and to assess impacts, including the area potentially affected by a major oil spill, include:

- **The proposed Facility study area** is located at the Port of Vancouver including the northwestern corner of Terminal 5, the storage area (Area 300), Berths 13 and 14 in Terminal 4, and pipeline areas that connect these three areas. The proposed Facility study area includes the Project vicinity and areas within 1 mile of the proposed Facility because aquatic species are generally mobile and can be affected by noise, disturbance, and habitat connectivity at a distance.
- **The rail corridor study area** includes the rail route from Williston, North Dakota, through Montana, Idaho, and the cities of Spokane and Pasco to the Port, including a 0.5-mile corridor along each side of the rail track.
- **The rail-Columbia River study area** includes the corridor that extends 216 river miles along the Columbia River between Kennewick and the Port, including an area extending 1 mile downstream from the Port. This study area is used to address potential crude oil spills, fires, and

1 The direct uptake of aquatic organisms by the suction field generated by water intakes on vessels

explosions in Chapter 4. The rail-Columbia River corridor covers all contiguous side/off channels, sloughs and associated wetlands, and adjacent riparian and upland habitats within 0.25 mile of the river shoreline. The rail and mid-Columbia River corridors overlap and extend into Oregon.

- **The vessel corridor study area** includes vessel routes between the Port and the Pacific Ocean to the 3-nmi boundary; this corridor extends 106 river miles along the Columbia River and includes all contiguous side/off-channels,[2] sloughs[3] and associated wetlands, and adjacent riparian and upland habitats within 0.25 mile of the river shoreline. For species that reside in marine waters (e.g., whales, marine turtles), the discussion of impacts within the "vessel corridor" includes areas beyond the 3-nmi boundary.

The affected environment for aquatic resources was developed based on identification of existing habitats and species usage within the study areas. The assessment of impacts to aquatic resources is based in part on information provided by the Applicant (BergerABAM 2014a) and independently reviewed findings from the BE prepared for the USACE as part of the Section 10 and Section 404 permit review process (Berger ABAM 2014b) and supplemented with additional information. Analyses were based on the following data sources:

- Aquatic habitats within Washington were identified using a combination of spatial data and locally focused literature sources to describe the presence and distribution of habitats within the study areas. National Wetland Inventory spatial data (USFWS 2015a) were used to classify deep or shallow riverine habitat and wetland areas. Wetland areas were further explored by comparing their spatial distribution to maps produced by the USGS Columbia River Estuary Ecosystem Classification (Simenstad et al. 2011) and by the Lower Columbia River Subbasin Plan (LCFRB 2010).
- The Pacific Fishery Management Council (PFMC) and NOAA EFH maps and databases were reviewed to identify the occurrence of EFH within the proposed Facility, rail corridor, and vessel corridor study areas within Washington (NMFS 2015).
- NMFS and USFWS data were used to update special-status species occurrences within the respective study areas.
- NMFS, USFWS, and WDFW data were used to update general species occurrences within the respective study areas.
- Ecology Vessel Entry and Transit (VEAT) Counts was used to characterize deep-draft vessel traffic in the vessel corridor study area (Ecology 2014).
- Columbia River Crossing Test Pile Project Hydroacoustic Monitoring Final Report (DEA 2011) and Noise Impact Assessment and Noise Reduction Strategies. Biological assessment preparation for transportation projects advanced training manual (WSDOT 2014) was reviewed to define baseline underwater noise levels in the Columbia River.

Special-status species are those species that are listed as threatened or endangered by the USFWS or NMFS under the ESA and species afforded federal protection under the Magnuson-Stevens Act, Marine Mammal Protection Act (MMPA), or state statutes, including state-listed threatened or endangered species. Discussions of special-status species are included below.

2 Aquatic habitats with direct connection to the basin's river network.

3 Swamp or shallow lake system, usually a backwater to a larger waterbody.

3.6.2 Affected Environment

3.6.2.1 Habitat Types in all Study Areas

This section describes aquatic habitat types present in all of the study areas described above. Habitat types discussed are:

- Deep Freshwater Habitat
- Shallow Water, Tidal Flats Habitat, and Shallow-Estuarine Bays
- Freshwater Tidal Wetland Habitat
- Man-Made Structures
- Open Ocean and Columbia River Plume
- Waterbodies Crossed by the Rail Corridor
- Essential Fish Habitat

Deep Freshwater Habitat

The riverine habitat in the marine terminal vicinity is categorized by the National Wetland Inventory as permanently flooded, tidally-influenced riverine deepwater habitat. Deepwater habitat is defined as water that is 6-feet deep or deeper and includes the main navigation channel, side channels, and the area of the river between the navigation channel and shallow-water zone. Deepwater habitats account for most of the open water present in the Columbia River estuary.

Deepwater areas lack emergent vegetation and tend to have rocky, sandy, or occasionally submerged aquatic vegetative habitats. The Columbia River navigation channel is deepwater habitat that has been altered in places by dredging activities. The Columbia River Navigation Channel begins at the mouth of the Columbia River and is maintained by USACE at a depth of approximately 43 feet and a width of approximately 600 feet.

Waters or side channels are typically shallower than those of the main navigation channel. Side channel deepwater habitat ranges up to 18 feet below MLLW, while the main channel deepwater habitat includes water deeper than 18 feet. Deepwater habitat in side channels and the main channel exhibits high water velocities compared to wetland areas (Fresh et al. 2005).

Small juvenile salmonids inhabit shallow water, and deepwater provides habitat for larger juvenile salmonids, particularly within the side channels. Eulachon migrate through the Columbia River on their way to spawning tributaries, and resident riverine fish can be found moving through this habitat throughout the year.

Shallow Water, Tidal Flats Habitat, and Shallow-Estuarine Bays

Sand deposition in the estuary has formed vast areas of sandflats and shoals (Systma et al. 2004). Dredge disposal has built up some of these areas into islands. The estuary has four large, shallow embayments (Grays, Baker, Youngs, and Cathlamet bays) (LCFRB 2010). Shallow water and tidal flats (e.g., mud- or sandflats) are defined as being between elevations of slightly above the MLLW to 6 feet below MLLW (Bottom et al. 2005; LCFRB 2010). They generally have a gentle slope, have low water flow, and are adjacent to large volume sources of fine grain sediments; in this case, the Columbia River (Fresh et al. 2005).

Sand- and mudflats tend to be physically stable and provide habitat to numerous burrowing and epibenthic species (organisms living at the surface of the seafloor). Mudflats typically have silt or clay sediments. In general, mudflats are biologically more diverse and productive than sandflats because they provide more organic material. The surface of the sediment is often devoid of vegetation, although mats of benthic microalgae are common (Oregon Explorer 2015). Tidal flats provide important nursery areas for flatfish and support populations of oysters, clams, crabs, snails, and other invertebrates (Oregon Explorer 2015). Beaches adjacent to sand- and mud-flats often are suitable spawning habitats for rock sole, sand lance, and surf smelt.

Shallow-water habitats that remain inundated often contain emergent vegetation or submerged aquatic vegetation, depending on the depth. Shallow waters tend to border shorelines. The amount of shallow water available fluctuates with river stage. Hydrologic control by dams and diking along the Columbia River has combined to limit the availability of shallow-water habitat and also effectively reduced the elevation of shallow water from its historical condition (Bottom et al. 2005, Fresh et al. 2005). Climate change is predicted to reduce the availability of these coastal habitats in the Pacific Northwest still further (National Wildlife Federation 2007). Research in the Columbia River estuary has indicated that shallow-water habitat is an important component for the migration of juvenile salmonids. Fry migrants may rely entirely on the estuary for nursery habitats. Studies in juvenile salmon behaviors have found correlations between fish size and water depth during migration, where the smaller fish prefer shallow waters (Kagley et al. 2005, Carter et al. 2009).

Freshwater Tidal Wetland Habitat

Many types of wetland are found along the vessel corridor, which can be divided into two main categories: estuarine tidal scrub-shrub and emergent wetlands. Tidal scrub-shrub consists of dense forest and shrub thickets, while emergent wetlands are most often found on floodplain margins and in backwater sloughs.

The shoreline of Hayden Island, located in the Columbia River between the Port of Vancouver on the Washington side and the city of Portland on the Oregon side, has both freshwater emergent and freshwater forested scrub-shrub wetlands. The western side of the island supports a high-quality riparian ecosystem. The confluence of the Willamette and Columbia rivers (i.e., Lower Columbia Slough) is approximately 1.5 miles downstream from the marine terminal. Specific wetland types near the confluence include palustrine forested deciduous wetlands, palustrine emergent persistent forested deciduous wetlands, and palustrine scrub-shrub deciduous tidal wetlands.

The riverine tidal wetlands located in the Project vicinity characteristically have unconsolidated substrates with less than 75 percent cover of stone, boulders, and bedrock and less than 30 percent cover of vegetation. The riverine tidal wetland class includes beaches, bars, and flats (USFWS 2015a). Tidal wetlands provide important habitat for both terrestrial and aquatic species. Salmonids, green sturgeon, and nearshore fish occupy this habitat.

The saline portion of the estuary is characterized by relatively simple vegetative assemblages, including salt-tolerant sedges and grasses. The freshwater tidal wetlands are more vegetatively complex, with unique wetlands such as Sitka spruce (*Picea sitchensis*) stands and dense scrub-shrub swamps consisting of red osier dogwood (*Cornus sericea*) and willow (*Salix* sp.) dominating the more common wetland assemblages in the mid-estuary (Johnson 2010). Above RM 40, vegetation composition changes and Sitka spruce gives way to deciduous species such as Pacific willow (*Salix lucida* ssp. *lasiandra*), Oregon ash (*Fraxinus latifolia*), and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*). Scrub-shrub swamps of composition similar to those in the lower estuary persist throughout the mid- and upper estuary, and freshwater tidal marshes consisting of wapato (*Sagittaria latifolia*), creeping spikerush (*Elocharis palustris*), common rush (*Juncus effusus*), and reed canary grass (*Phalaris arundinacea*) are common as well (Johnson 2010). Freshwater tidal forested wetlands are known to support high species diversity and provide essential habitat for a variety of fish and wildlife, including mammals, birds, and amphibians (USACE 1976). Freshwater tidal wetlands are important for sustaining aquatic organisms (Bottom et al. 2005). Freshwater tidal wetlands provide shade for water temperature control and contribute a high organic matter input into aquatic ecosystems. These areas also produce protective habitat as a result of large woody debris contributions to associated wetlands and riparian habitat (Johnson 2010).

Man-Made Structures

Man-made structures are common along the Columbia River, particularly in the marine terminal vicinity where industrial uses are the dominant land use (City of Portland 2005). Man-made structures in this vicinity mainly include piers and docks. Other man-made structures that occur throughout the Columbia River include levees, dikes, piers, pilings, riprap, marinas, building foundations, dredged material islands, and numerous other smaller structures, including tribal fishing weirs, placed in the vessel corridor by human activities. Most man-made structures occur at or above MLLW, but many docks and piers extend below MLLW or extend out over the water surface (such as piers and marina floating docks) to shade areas of the shallow subtidal habitats. Most man-made structures are “hard,” that is, the substratum is similar to rocky or consolidated habitat and they tend to support similar biological communities. On wharves, docks, floats, aquaculture pens, and similar structures, the biological community is commonly categorized as the “fouling community,” which includes organisms capable of attaching to surfaces like stone, concrete, wood, piers, docks, and boat hulls (Systma et al. 2004). These physical structures can also provide habitat for other small invertebrates, algae, and juvenile fish, and serve as haulout sites for pinnipeds. These structures may also serve as significant roosting or nesting areas for a variety of marine birds and raptors.

Open Ocean and Columbia River Plume

The Columbia River plume extends approximately 4 miles into the ocean beyond the river mouth (EPA 2015) and is defined as the layer of Columbia River water in the nearshore Pacific Ocean (Carter et al. 2009). The plume can be identified by a reduced salinity contour near the ocean surface of 31 parts per thousand (Fresh et al. 2005). The Columbia River plume varies seasonally in extent and location with discharge, winds, and ocean currents, but it is typically oriented northward on the continental shelf off the Washington coast during fall and winter and southward beyond the shelf off the Oregon coast during spring and summer (Hickey and Banas 2003, NMFS 2006). The plume provides a food-rich habitat where juvenile salmonids have the opportunity for significant growth during the period of adjustment to the more saline ocean environment (NMFS 2006). Sediment and nutrients transported in the plume provide refuge from predators and fuel primary productivity. The plume may also benefit juvenile salmonids by distributing them away from predation pressure that occurs closer to shore and by concentrating food sources such as zooplankton (Fresh et al. 2005).

The open ocean also provides habitat for abundant aquatic life outside of the plume. Coastal pelagic species (CPS), rockfish, flatfish, sharks, skates, and chimeras can be found in this habitat. The ocean conditions on the continental shelf off the US coast are known for rough seas and large waves. The continental shelf is composed primarily of soft sediment and glacial deposits of cobble, gravel, and boulders, punctuated by rock outcrops, and it is inhabited by creatures such as flatfish, rockfish, octopi, brittle stars, and sea pens that have adapted to the darkness, cold, and pressure of the seafloor (NOAA 2008).

Waterbodies Crossed by the Rail Corridor

Within Washington, the rail corridor would cross many streams and run adjacent to the Columbia River. The existing rail line within Washington crosses over 75 fish-bearing waterbodies and is adjacent to more than 500 streams and waterbodies between the Washington-Idaho border and the proposed Facility

(Appendix P.3). Four WDNR stream types (WDNR 2015) occur within and adjacent to the rail corridor within Washington:

- Type F (fish bearing) – Streams and waterbodies that are known to be used by fish, or meet the physical criteria to be potentially used by fish. Fish streams may or may not have flowing water all year; they may be perennial or seasonal.
- Type S (shoreline) – Streams and waterbodies that are designated "shorelines of the state" as defined in RCW 90.58.030.
- Type N[4] (nonfish bearing) – Streams that do not meet the physical criteria of a Type F stream
- Type U[5] (not classified) – Untyped water features that still need to be verified and identified.

Table 3.6-1 lists the number of waterbodies within the rail corridor study area by WDNR stream type classification. Of these, 75 are fish bearing. Major Washington stream crossings along the rail route include the Spokane River, Hangman Creek, Negro Creek, Columbia River (at Pasco), Klickitat River, White Salmon River, Wind River, and Washougal River.

Table 3.6-1. Stream Types Crossed by the Rail Corridor in Washington

Stream Type	Number
Type F (fish bearing)	75
Type S (shoreline)	44
Type N (nonfish bearing)	132
Type U (not classified)	298
Total	549

Source: WDNR 2006

East of Spokane, Washington, the rail line crosses the Spokane River. No anadromous fish species are found in the Spokane River due to the operation of hydroelectric facilities. Over 35 species of fish, including 20 native species, are found in the Spokane River subbasin. The rail line crosses the Spokane River above Spokane Falls. The upper Spokane River provides habitat for brown trout, land-locked Chinook salmon, cutthroat trout, rainbow trout, northern pikeminnow, and largescale sucker (Ecology 2011).

West of Spokane, Washington, the rail line crosses Hangman Creek. Hangman Creek has compromised water quality and species composition reflects the degraded water conditions (warm temperatures and slow-moving water). Sculpin, shiners, suckers, and other bottom-feeding fish are the dominant species (Spokane County Conservation District 2000). Continuing west, the rail line crosses Negro Creek, an inlet stream to Sprague Lake. Sprague Lake and associated waterbodies have been stocked with warm-water species, including largemouth bass, smallmouth bass, walleye, and bluegill. Rainbow trout and Lahontan cutthroat trout, which is listed as threatened under federal ESA, are also stocked (Korth 2007).

At Pasco, Washington, the rail line crosses the Columbia River. The mainstem Columbia River provides habitat for many species of salmonids, including listed Chinook, coho, and steelhead. It also provides habitat for sturgeon, lamprey, and game fish (e.g., walleye, bass, and catfish). Tributaries to the Columbia

4 While not fish bearing, these streams could support other species.

5 While not fish bearing, these streams could support other species.

River Gorge that are crossed by the rail line include the Washougal, Wind, White Salmon, and Klickitat rivers, which all enter the Columbia River west of Pasco, Washington. These rivers support listed salmonids, including Chinook, chum, coho, and steelhead. They also provide habitat for cutthroat trout, Pacific lamprey, and game fish populations (LCFRB 2010).

Between Williston, North Dakota, and the Washington-Idaho border, the rail corridor traverses two major watersheds: the Missouri River watershed in eastern Montana and North Dakota and the Columbia River in northern Idaho and western Montana. The Missouri River, the longest river in North America, has its headwaters in the Rocky Mountains of western Montana. The river flows easterly through Montana and then southeasterly through western North Dakota, ultimately emptying into the Mississippi River north of St. Louis, Missouri. Major rivers within this portion of the out-of-state rail corridor include the Marias and Milk rivers, which enter the Missouri River from the north, and the Yellowstone River and its tributaries including the Bighorn, Tongue, and Powder rivers. The Little Missouri River is another major tributary, which drains into Lake Sakakawea near the eastern end of the out-of-state rail corridor.

The Missouri River and its tributaries provides habitat for many types of fish, including paddlefish, sturgeon, pike, burbot, sticklebacks, sunfish, bass, suckers, dace, carp, perch, catfish, lake whitefish, rainbow trout, and brown trout (Stash 2001). The main tributaries to the Columbia River crossed by the rail line are the Kootenai and Flathead rivers. The drainages of these rivers share many species with the mainstem Columbia, as previously discussed. Noteworthy fish species in the Kootenai River include westslope cutthroat trout, bull trout, kokanee salmon, rainbow trout, and white sturgeon. Many other species occur as well, including lake trout and other game fish. The Flathead River supports bull trout, rainbow trout, kokanee, cutthroat trout, mountain whitefish, slimy sculpin, and large-scale suckers (Martin et al. 1987).

Essential Fish Habitat

EFH is designated for commercially-fished species managed under the Magnuson-Stevens Act. The Magnuson-Stevens Act requires federal fishery management plans developed by NMFS and the PFMC to describe the habitat essential to the managed fish species and describe threats to that habitat from both fishing and nonfishing activities. Within the vessel corridor study area, the PFMC has designated EFH for Pacific Coast salmon, groundfish, and pelagic species; these habitats occur within the vessel corridor for all three groups and would also include the proposed Facility study area and rail corridor for Pacific Coast salmon. EFH requirements for these groups are described in more detail below

Pacific Coast Salmon Essential Fish Habitat (Chinook, Coho, and Pink)

The Pacific salmon management unit includes Chinook, coho, and pink salmon. EFH for Pacific salmon in the study area include those elements associated with adult migration pathways and marine habitat. Important marine elements of Pacific salmon EFH include adequate water quality, water temperature, prey species and forage base, and adequate depth, cover, marine vegetation, and algae in estuarine and nearshore habitats. EFH for Pacific salmon in freshwater includes all streams, lakes, ponds, wetlands, and other currently viable bodies of freshwater and the substrates within those waterbodies accessible to Pacific salmon. Designated EFH for salmonid species in estuarine and marine areas includes nearshore and tidally submerged environments within state territorial waters out to the full extent of the exclusive economic zone (EEZ; 370.4 kilometers) offshore from Washington (PFMC 1999). Pacific coast salmon EFH includes areas within the vicinity of the proposed Terminal and in rail and vessel corridors.

Groundfish

NMFS defined EFH for Pacific groundfish (CFR 660.395; 5/11/2006) to include those waters and substrate necessary to groundfish for spawning, breeding, feeding, or growth to maturity (16 USC 1802 (10)). EFH for Pacific Coast groundfish includes all waters and substrate within areas with a depth less than or equal to 3,500 meters (11,483 feet) shoreward to the mean higher high water level or the upriver extent of saltwater intrusion (defined as upstream and landward to where ocean-derived salts measure less than 0.5 part per thousand during the period of average annual low flow). EFH habitat types (units) with the potential to be present within the study area include (NMFS 2006):

- **Estuarine.** Those waters, substrates, and associated biological communities within bays and estuaries of the Washington, Oregon, and California coasts, seaward from the high tide line or extent of upriver saltwater intrusion
- **Non-Rocky Shelf.** Those waters, substrates, and associated biological communities living on or within 10 meters (33 feet) overlying the substrates of the Continental Shelf, excluding the rocky shelf and canyon composites, from the high tide line to the shelf break.
- **Canyon.** Those waters, substrates, and associated biological communities living within submarine canyons, including the walls, beds, seafloor, and any outcrops or landslide morphology, such as slump scarps and debris fields.
- **Continental Slope/Basin.** Those waters, substrates, and associated biological communities living on or within 20 meters (66 feet) overlying the substrate of the continental slope and basin below the shelf break and extending to the westward boundary of the EEZ.
- **Neritic Zone.** Those waters and biological communities living in the water column more than 20 meters (66 feet) above the continental shelf.
- **Oceanic Zone.** Those waters and biological communities living in the water column more than 20 meters (66 feet) above the continental slope and abyssal plain, extending to the westward boundary of the EEZ.

Pelagic Species

EFH for CPS including finfish (northern anchovy, Pacific sardine, Pacific (chub), mackerel, and jack mackerel) and market squid occurs from the shorelines of California, Oregon, and Washington westward to the EEZ and above the thermocline where sea-surface temperatures range between 10 degrees Celsius (°C) (50 degrees Fahrenheit [°F]) and 26°C (79°F). During colder winters, the northern extent of EFH for CPS may be as far south as Cape Mendocino (California), and during warm summers it may extend into Alaska’s Aleutian Islands (PFMC 1999). In 2006, the Coastal Pelagic Species: Fishery Management Plan was amended to include all krill species, to prohibit their harvest, and to identify EFH for them. EFH for *Thysanoessa spinifera* includes waters from the baseline from which the shoreline is measured to the 500 femtometers (fm; 914 meters [3,000 feet]) isobaths,[6] from the US- Mexico north to the US-Canada border, from the surface to 100 meters deep. EFH for *Euphausia pacifica* and other krill species includes waters from the baseline from which the shoreline is measured seaward to the 1,000 femtometers (1,829 meters [6,207 feet]) isobath, from the US-Mexico north to the US-Canada border, from the surface to 400 meters (1,312 feet) deep. Within the study area, geographic boundary of pelagic EFH is defined to be all marine and estuarine waters from the shoreline along the Washington and Oregon coasts 3 miles offshore to the beginning of the EEZ and above the thermocline.

3.6.2.2 Species Presence in all Study Areas

Protected Fish Species and Habitat Associations

Of the fishes occurring in the study areas, green sturgeon, eulachon, and six species of salmonids are listed as threatened (Table 3.6-2). Federal candidate species and species of concern are not included in this table.

6 An imaginary line or a line on a map or chart that connects all points having the same depth below a water surface.

Table 3.6-2. Protected Fish in the Study Areas

Species	Protection Status		Life Stages Occurring in Study Areas		
	Federal Status	WA State Status	Terminal	Rail Corridor	Vessel Corridor
Salmonids					
Chinook salmon *(Oncorhynchus tshawytscha)*	Threatened (4 ESUs) • Upper Willamette River • Snake River Spring/Summer-run • Snake River Fall-run • Lower Columbia River Endangered (1 ESU) Upper Columbia River Spring-run	Candidate (4 ESUs) • Lower Columbia River • Upper Columbia River Spring-run • Snake River Spring/Summer-run • Snake River Fall-run Not Listed (1 ESU) Upper Willamette River	Juveniles • Rearing • Migration Adults • In-migration	Juveniles • Rearing • Outmigration Adults • In-migration • Spawning	Juveniles • Rearing • Outmigration • Smolting Adults • Year-round foraging • In-migration
Chum salmon *(Oncorhynchus keta)*	Threatened (1 ESU) Lower Columbia River	Candidate (1 ESU) Lower Columbia River	Juveniles • Outmigration • Smolting Adults • In-migration	Juveniles • Outmigration • Smolting Adults • In-migration	Juveniles • Rearing • Outmigration • Smolting Adults • Year-round foraging • In-migration • Spawning
Coho salmon *(Oncorhynchus kisutch)*	Threatened (1 ESU) Lower Columbia/SW WA	Not Listed	Juveniles • Outmigration Adults • In-migration	Juveniles • Outmigration Adults • In-migration	Juveniles • Rearing • Outmigration • Smolting Adults • Year-round foraging • In-migration
Sockeye salmon *(Oncorhynchus nerka)*	Endangered (1 ESU) Snake River	Candidate (1 ESU) Snake River	Juveniles • Outmigration Adults • In-migration	Juveniles • Outmigration • Smolting Adults • In-migration	Juveniles • Outmigration • Smolting Adults • Year-round foraging • In-migration

Table 3.6-2. Protected Fish in the Study Areas

<table>
<tr><th rowspan="2">Species</th><th colspan="2">Protection Status</th><th colspan="3">Life Stages Occurring in Study Areas</th></tr>
<tr><th>Federal Status</th><th>WA State Status</th><th>Terminal</th><th>Rail Corridor</th><th>Vessel Corridor</th></tr>
<tr><td>Steelhead trout
(Oncorhynchus mykiss)</td><td>Threatened (5 DPSs)
• Upper Columbia River
• Snake River Basin
• Middle Columbia River
• Upper Willamette River
• Lower Columbia River</td><td>Candidate (4 DPSs)
• Upper Columbia
• Snake River Basin
• Middle Columbia
• Lower Columbia
Not Listed (1 DPS)
Upper Willamette River</td><td>Juveniles
• Rearing
• Outmigration
Adults
• In-migration</td><td>Juveniles
• Rearing
• Outmigration
Adults
• In-migration</td><td>Juveniles
• Rearing
• Outmigration
• Smolting
Adults
• Year-round foraging
• In-migration</td></tr>
<tr><td>Bull trout
(Salvelinus confluentus)</td><td>Threatened (1 DPS)
Coterminous US</td><td>Candidate
Coterminous US</td><td>Adults
• Foraging
• Migration
• Overwintering</td><td>Juveniles
• Rearing
Adults
• Spawning
• Foraging
• Migration
• Overwintering</td><td>Adults
• Foraging
• Migration
• Overwintering</td></tr>
<tr><td colspan="6">Lampreys</td></tr>
<tr><td>Pacific lamprey
(Entosphenus tridentata)</td><td>Species of Concern</td><td>Monitor</td><td>Juveniles
• Rearing
• Outmigration
Adults
• Migration</td><td>Juveniles
• Rearing
• Outmigration
Adults
• Migration</td><td>Juveniles
• Rearing
• Outmigration
Adults
• Migration
• Foraging</td></tr>
<tr><td>River lamprey
(Lampetra ayresii)</td><td>Species of Concern</td><td>Candidate</td><td>Juveniles
• Rearing
• Outmigration
Adults
• Migration</td><td>Juveniles
• Rearing
• Outmigration
Adults
• Migration</td><td>Juveniles
• Rearing
• Outmigration
Adults
• Migration
• Foraging</td></tr>
<tr><td colspan="6">Foragefish</td></tr>
<tr><td>Eulachon
(Thaleichthys pacificus)</td><td>Threatened</td><td>Candidate</td><td>Juveniles
• Dispersal
Adults
• Spawning
• Migration</td><td>Juveniles
• Dispersal
Adults
• Spawning
• Migration</td><td>Juveniles
• Dispersal
• Rearing
Adults
• Year-round foraging
• Spawning
• Migration</td></tr>
</table>

Table 3.6-2. Protected Fish in the Study Areas

Species	Protection Status		Life Stages Occurring in Study Areas		
	Federal Status	WA State Status	Terminal	Rail Corridor	Vessel Corridor
Groundfish					
Green sturgeon (*Acipenser medirostris*)	Threatened	Not Listed	Juveniles/Subadults • Foraging Adults • Foraging	Juveniles/Subadults • Foraging Adults • Foraging	Juveniles/ Subadults • Foraging Adults • Foraging

Source for Protection Status: WDFW 2015a
DPS = distinct population segment, ESU = evolutionary significant unit

Pacific Salmon

Salmonids include salmon, trout, and char and are the most ubiquitous, commercially significant, and ecologically and culturally prominent group of fishes in the Pacific Northwest (Groot and Margolis 1991). Five species of ESA-listed Pacific salmon (*Oncorhynchus* spp.) have the potential to occur in the study areas:

- Chinook salmon (*O. tshawytscha*)
- Chum salmon (*O. keta*)
- Coho salmon (*O. kisutch*)
- Sockeye salmon (*O. nerka*)
- Steelhead trout (*O. mykiss*)

Generally, all of the listed Pacific salmonids share a similar life cycle, which includes freshwater incubation, hatching, emergence, and eventual transition to saltwater (smolting). Salmon populations are categorized into “evolutionary significant units” (ESUs) or “distinct population segments” (DPSs) based on characteristics such as the amount of time spent rearing in freshwater and the seasonality of spawning runs. A single species may exhibit a variety of behaviors between ESUs/DPSs. The analysis here has not attempted to relate the impacts specifically to population units, but focuses on the life-history stages of listed Pacific salmonids that could occur within the study areas.

Salmon use an extensive network of waterbodies for various stages of their life cycle, including small headwater streams, rivers, lakes, wetlands and floodplain habitats, estuaries, and nearshore and offshore marine environments. Salmonids may express freshwater resident forms, anadromous forms, or both. Both freshwater residency and anadromy are addressed in this EIS because of the extent of the vessel and rail corridors.

In general, the life cycle of an anadromous salmonid species begins with adults migrating from the ocean upstream in freshwater to cool, clean headwaters to spawn. Spawning takes place in gravel/cobble substrates mostly free of fine sediment. Females dig nests in the gravel called “redds” and deposit eggs simultaneously as males deposit sperm. Once eggs hatch, alevins (newly hatched young that still have an attached yolk sack) remain in the interstitial gravel of redds, while utilizing nutrition from the yolk sac. When the yolk sack is mostly or completely absorbed, fry emerge from redds and swim freely in the stream. Juveniles rear in freshwater from 0 to 3 years (depending on the species) before migrating downstream to the ocean and may also rear in estuaries prior to ocean entry. The developmental process that stimulates juvenile salmon to migrate to the ocean and prepare for the transition to saltwater is called "smolting" and juvenile salmon undergoing the transition are called "smolts." The amount of time required to adjust to saltwater differs among species. Some species, such as chum salmon, make the transition quickly while others, such as sockeye, Chinook, coho and steelhead, may take many months or even years. Most anadromous species spend 1 to 4 years growing in the ocean before returning as adults to their natal watersheds. The timing of adult return from the ocean to freshwater streams varies by species and population, and seasonal migrations are referred to as "runs."

Chinook Salmon Habitat Use

Populations of Chinook, called "runs," are grouped by the time of year (spring, summer, fall, winter) that they return to rivers to begin spawning, and Chinook can be found entering spawning rivers throughout the year. Mature Chinook tend to use deeper water and larger gravel for spawning than other salmonids. Eggs hatch in 3 to 5 months and juvenile Chinook grow and feed as they migrate downstream to the ocean, stopping to rear in coastal estuaries before entering the ocean. Juvenile Chinook may spend from 3 months to 2 years in freshwater before entering the ocean as smolts (NOAA 2015a). Chinook are opportunistic feeders at all life stages and eat insects, crustaceans, invertebrates, and other fish.

Chum Salmon Habitat Use

Chum salmon spend more of their lives in marine waters than other Pacific salmonids and even spawn near coastal areas. Adult chum salmon run in the fall and spawn just a short distance upstream from the ocean. Eggs hatch between December and February and juvenile chum salmon emerge from the gravel in 1 to 2 months, depending on stream temperature. Juvenile chum salmon outmigrate to the estuary immediately after emergence (Salo 1991) and are commonly found in the estuary from March through May (WDFW 2015b). Migrating juvenile chum salmon feed mainly on insect larvae.

Coho Salmon Habitat Use

Coho generally spawn in the tributaries and headwaters of large rivers where low-velocity water and small-sized gravel are available. Eggs are deposited in the fall and juveniles emerge the following spring (WDFW 2015c). Juveniles remain in freshwater for 1 year and move in and out of channels, sloughs, ponds, and smaller streams to feed and seek shelter. Juveniles migrate to the estuary and then spend less than a month feeding and adapting to saltwater before entering the ocean. Juveniles feed on insects, invertebrates, and crustaceans. Adults and larger juveniles feed on fish and squid. Coho live in the ocean for 2 years before returning to their natal streams to spawn and die. Migration typically occurs between June and February with spawning between September and March (Weitkamp et al. 1995).

Sockeye Salmon Habitat Use

Sockeye salmon migrate through the Lower Columbia River during June and July with normal peak passage at Bonneville Dam around July 1. The destinations of Columbia River sockeye are the Wenatchee, Okanogan, and Snake river basins (WDFW 2015d). In freshwater, sockeye feed on aquatic insects and plankton, while in the ocean they feed on amphipods, copepods, squid, and other fish (NOAA 2014a). Sockeye salmon spawn in freshwater lakes and use rivers for migration. Juvenile sockeye spend about half of their life span rearing in lakes before heading to estuaries and the sea as smolts. Some sockeye do not migrate to the sea and instead spend their entire lives in freshwater. These nonanadromous sockeye are known as kokanee.

Steelhead Trout Habitat Use

Steelhead are unlike the other listed salmonids in that they can spawn more than once (iteroparous), while other species spawn and then die (semelparous). Steelhead may spend up to 7 years in freshwater before smoltification and up to 3 years in saltwater before returning to spawn (Good and Waples nd). Spawning migrations take place throughout the year. The Columbia River may have migrating steelhead all year long. Steelhead historically occurred throughout much of the Columbia River; however, Chief Joseph Dam now blocks their migration.

Bull Trout Life History and Habitat Requirements

Bull trout are a federally listed threatened species, which could occur in the study areas in Washington, Oregon, Idaho, and western Montana. A recovery plan has been prepared for bull trout (USFWS 2014b). The USFWS designated six bull trout recovery units for the population, three of which intersect with the study areas: the Coastal Recovery Unit includes the proposed Facility site and the vessel corridor; the Mid-Columbia and Columbia River Headwaters recovery units intersect the rail corridor.

Bull trout express both resident and migratory life-history strategies. Resident bull trout complete their entire life cycle within the tributary or streams in which they spawn and rear. Migratory bull trout spawn and rear in streams and then migrate to lakes (adfluvial) or rivers (fluvial) or to the sea (anadromous). No anadromous bull trout occur within the vessel corridor; however, migratory adfluvial, migratory fluvial, and resident bull trout could occur in the vessel corridor.

Bull trout have very specific habitat requirements for spawning and rearing. They include appropriate substrate (e.g., loose, clean gravel with minimal fine sediment); cold water; excellent water quality with high dissolved oxygen and minimal contamination from chemicals and sediments; low gradient stream segments with stable channel structure; and presence of complex cover such as woody material, undercut banks, boulders, and pools (USFWS 2014).

Bull trout rely on a variety habitat types during their life cycle for foraging, migration, overwintering, spawning, and rearing (USFWS 2014). Bull trout may be present in the Project vicinity, in waterbodies crossed by the rail routes, and in the vessel corridor.

Lampreys

Pacific and River Lamprey Life History and Habitat Requirements

Two species of lamprey are designated as sensitive species and are native to the Columbia River Basin. On January 23, 2003, 11 conservation groups filed a petition to list these two species as endangered or threatened under the ESA. Currently, the Pacific lamprey (*Entosphenus tridentata*) is listed as a species of concern by USFWS and as a monitor species by WDFW. The river lamprey (*Lampetra ayresii*) is also listed as a federal species of concern and is a candidate for listing by WDFW.

In Washington, Pacific lamprey are distributed throughout streams and rivers of the Columbia River Basin up to Chief Joseph Dam, and throughout streams and rivers west of the Cascade Mountains. Impassable dams and other man-made barriers have reduced historical distribution in Washington. Conservation actions have included translocation of adults trapped at Lower Columbia River dams (Bonneville, The Dalles, John Day, and McNary) to upper basin areas with low abundance (WDFW 2015e).

Current Washington distribution of the river lamprey is not well-known, but includes Pacific coast rivers from the Columbia River northward, Puget Sound rivers, and within the Columbia River Basin, with documentation for the Yakima Basin.

Pacific and river lampreys are anadromous and have very similar life cycles. The larval stage, called an ammocoete, spends between 4 and 7 years filter feeding on diatoms and detritus in streams and rivers before transforming into the juvenile parasitic stage called a macropthalmia. Juveniles develop teeth, a sucker-like disc, and the ability to tolerate salt water and then migrate to the ocean. Adults are parasitic on fishes for 1 to 3 years and then migrate back to fresh water to spawn. Adults stop feeding during the return migration, overwinter in fresh water until they spawn the following year, and then die (WDFW 2015e). Pacific lampreys spawn from June to July while river lampreys spawn from April to June. The mainstem Columbia River in the vessel corridor, terminal vicinity, and along the rail corridor provides bottom habitat for juvenile lamprey as well as a migratory route for adults.

Forage Fish

Pacific Eulachon Life History and Habitat Requirements

Pacific eulachon or smelt (*Thaleichthys pacificus*) are a federally listed threatened species, which could occur in the study areas in Washington and Oregon. Critical Habitat was designated in 2013 and includes portions of the study areas (NMFS and NOAA 2011). A draft recovery plan for eulachon is under preparation (NOAA 2013). Eulachon are anadromous forage fish that inhabit the ocean and coastal rivers along northwestern North America. Eulachon range geographically from Northern California to the Bering Sea. Eulachon spawn in freshwater but spend most (96 percent) of their adult lives in saltwater.

Spawning rivers may be turbid or clear, but all are thought to have spring freshets, characteristic of rivers draining large snowpacks or glaciers (Hay and McCarter 2000, as reported in Willson et al. 2006). Spawning substrates can range from silt, sand, or gravel to cobble and detritus, but sand appears to be most common. Most eulachon are semelparous, spawning only once and then dying. Eulachon eggs are enclosed in a double membrane; after fertilization in the water, the outer membrane breaks and turns inside out, creating a sticky stalk, which anchors the eggs to the substrate (Hart and McHugh 1944, Hay and Carter 2000). Eulachon eggs hatch in 20 to 40 days with incubation time dependent on water temperature (Smith and Saalfeld 1955, Langer et al. 1977). Shortly after hatching, the larvae are carried downstream and dispersed by estuarine, tidal, and ocean currents. Larval eulachon may remain in low-salinity, surface waters of estuaries for several weeks or longer (Hay and McCarter 2000) before entering the ocean. Juvenile eulachon are thought to imprint on the chemical signature/smell of their natal river basin. However, because juvenile eulachon spend only a short time in freshwater environments eulachon stray between spawning sites (Hay and Carter 2000). Once juvenile eulachon enter the ocean, they move from shallow nearshore areas to deeper areas over the continental shelf. Larvae and young juveniles become widely distributed in coastal waters, where they are typically found near the ocean bottom in waters 20 to 150 meters deep (66 to 292 feet) (Hay and McCarter 2000) and sometimes as deep as 182 meters (597 feet) (Barraclough 1964).

The Columbia River is a very productive spawning area for eulachon. The mainstem of the Lower Columbia River provides spawning and incubation sites and a migratory corridor to spawning areas in the tributaries. The Lower Columbia River and its tributaries support the largest known spawning run of eulachon (NOAA 2011). Within the Columbia River Basin, the major and most consistent spawning runs return to the mainstem of the Columbia River and the Cowlitz River (Gustafson et al. 2010). Other important tributaries include Grays, Elochoman, Kalama, and Lewis rivers in Washington and the Sandy River in Oregon (NOAA 2011). Eulachon migration into the Columbia River has been documented as generally beginning in December, peaking in February, and continuing through May (WDFW and ODFW 2001).

Groundfish

North American Green Sturgeon Life History and Habitat Requirements

Two DPSs of green sturgeon (*Acipenser medirostris*) occur in the study areas. The Southern DPS is a federally listed threatened species, while the Pacific-northern DPS is federally listed as a species of concern (NOAA 2014b). Critical habitat, which includes the Columbia River and its estuary, was designated in 2014. The northern DPS originates from the Rogue and Klamath rivers, while the southern

DPS originates from the Sacramento River (NOAA 2009). This species is found along the west coast of Mexico, the United States, and Canada. Although green sturgeon are known to spawn in only three rivers: the Rogue River in Oregon and the Klamath and Sacramento rivers in California, green sturgeon occupy many other rivers and estuaries along the Pacific coast, including the Columbia River.

Green sturgeon are anadromous and are the most marine of all sturgeon species (NOAA 2014b). Adults live in oceanic waters, bays, and estuaries when not spawning. Green sturgeon are known to forage in estuaries and bays ranging from San Francisco Bay to British Columbia. Mature males range from 4.5 to 6.5 feet (1.4 to 2 meters) in “fork length” and do not mature until they are at least 15 years old, while mature females range from 5 to 7 feet (1.6 to 2.2 meters) fork length and do not mature until they are at least 17 years old (NOAA 2014b). Juvenile green sturgeon reside in freshwater and estuaries for several years before moving to saltwater. Adults migrate back into estuaries and freshwater to spawn every 2 to 5 years. Migration begins in late February and spawning occurs from March to July, peaking from April to June.

The Columbia River provides foraging habitat for subadult and adult green sturgeon and this species could occur in the Project vicinity. Green sturgeon can be found year-round in the mainstem Columbia River up to Bonneville Dam, and individuals congregate in the Columbia River estuary during the late summer and early fall (Adams et al. 2002).

Nonprotected Fish Species and Habitat Associations

Nonlisted fish species that may occur in the study areas include the following groups of fishes:

- Salmonids: Pink salmon and mountain whitefish
- Resident riverine fishes: minnow, sucker, freshwater sculpin, and stickleback
- Nearshore fishes: forage fish (e.g., surf smelt, Pacific sand lance, herring), surfperch, and pipefish
- Coastal pelagic species: northern anchovy, jack mackerel, Pacific sardine, Pacific (chub or blue) mackerel, and market squid
- Rockfish
- Sharks, skates, and chimaeras
- Flatfish (e.g., English sole, arrowtooth flounder)

Nonlisted fish species and their potential to occur within the study areas are provided in Table 3.6-3. Life history and habitat requirements for these fish groups are provided below.

Table 3.6-3. Nonlisted Fish Presence in the Study Areas

Species	Occurs in Study Areas		
	Proposed Facility	Rail Corridor	Vessel Corridor
Salmonids			
Pink Salmon *(Oncorhynchus gorbuscha)*	No	No	Yes
Mountain Whitefish *(Prosopium williamsoni)*	Yes	Yes	Yes
Resident Riverine Fish			
Minnows	Yes	Yes	Yes
Suckers	Yes	Yes	Yes

Table 3.6-3. Nonlisted Fish Presence in the Study Areas

Species	Occurs in Study Areas		
	Proposed Facility	Rail Corridor	Vessel Corridor
Freshwater Sculpins	Yes	Yes	Yes
Stickleback	Yes	Yes	Yes
Nearshore Fish			
Forage Fish	No	No	Yes
Surfperch	No	No	Yes
Pipefish	No	No	Yes
Nearshore Coastal Fish			
Coastal Pelagic Species	No	No	Yes
Rockfish	No	No	Yes
Sharks, Skates, and Chimeras			
Soupfin *(Galeorhinus galeus)*	No	No	Yes
Spiny dogfish *(Squalus acanthias)*	No	No	Yes
Skates	No	No	Yes
Flatfish			
Sole	No	No	Yes
Flounder	No	No	No
Arrowtooth Flounder Subgroup			
Arrowtooth flounder *(Atheresthes stomias)*	No	No	No
Pacific halibut *(Hippoglossus stenolepis)*	No	No	No
Slender sole *(Lyopsetta exilis)*	No	No	No
Petrale sole *(Eopsetta jordani)*	No	No	No
Rex sole *(Glyptocephalus zachirus)*	No	No	No
Curlfin sole *(Pleuronichthys decurrens)*	No	No	No

Salmonid Life History and Habitat Requirements

As mentioned above for protected salmon, not all salmonids are anadromous. Some species, such as mountain whitefish, complete their entire life cycle in freshwater. Resident forms of anadromous species may also entirely live in freshwater, rearing to maturation in headwater streams, lower mainstem river reaches (called “fluvial”), or in downstream lakes (called “adfluvial” or “lacustrine”). In all of these scenarios, at least some distance of migration usually occurs when adults move from rearing/feeding areas to upstream spawning grounds.

Two nonlisted salmonid species (pink salmon and mountain whitefish) have the potential to occur in the vessel and rail corridor.

Pink Salmon Habitat Use

Pink salmon are not known to have a sustained spawning population within the Columbia River Basin, and their occasional occurrence in the river is presumed to be due to straying of returning adults from other coastal drainages. A few to over a thousand fish may run in the Lower Columbia River each year.

Mountain Whitefish Habitat Use

Based on studies of mountain whitefish populations in upper portions of the Columbia River Basin, the Columbia River may be used as a migratory corridor between mainstem rearing and tributary spawning habitats, or as overwintering habitat. Shallow river margins may be used for juvenile rearing.

Resident Riverine Fish Life History and Habitat Requirements

Resident riverine fishes include species that spend their entire life cycle in freshwater habitats of the Columbia River and its tributaries. Some species make migrations between different freshwater habitat areas, and others may spend their entire life cycle in one area. This group includes a wide variety of species with a wide variety of life histories. Limited recreational fisheries exist for the larger species of suckers and minnows.

Resident riverine fishes in the vessel corridor are separated into four subgroups:

- **Minnows.** This group includes related species in the family Cyprinidae. Many native species (listed below) occur. Many nonnative species, such as the common carp, are established in the Columbia River.
- **Suckers.** This group includes related species in the family Catostomidae. All have specialized (‘sucker’) mouth morphology for eating algae from benthic surfaces.
- **Freshwater sculpins.** This group includes related species in the family Cottidae that reside in freshwater. Several related sculpins live in ocean and estuarine environments and are covered in nearshore fish. All sculpins live in benthic habitats.
- **Stickleback.** One species of stickleback is native to the Columbia River. Sticklebacks can live in freshwater or saltwater habitats but are not migratory and will generally spend their entire life cycle in one habitat type.

Minnows Habitat Use

The following species in the minnow group may be present in the vessel corridor:

- Chiselmouth *(Acrocheilus alutaceus)*
- Northern pikeminnow *(Ptychocheillus oregonensis)*
- Redside shiner *(Richardsonius balteatus)*
- Peamouth *(Mylocheilus caurinus)*
- Longnose dace *(Rhinichthys cataractae)*
- Speckled dace *(Rhinichthys osculus complex)*

Several characteristics of cyprinid fish distinguish them from other species. Their jaws are toothless; they chew their food using one or two rows of pharyngeal teeth and with gill rakers. They usually have large scales, but these scales are almost always absent from their head. Cyprinids range widely in size. They usually inhabit moderate to slow-flowing streams of all sizes and can be found in lakes. All cyprinids are egg-layers that spawn their eggs on various benthic surfaces in spring and summer. Cyprinids are sensitive to sound. They have a set of small bones called a Weberian organ that connect the inner ear to the swim bladder, thus amplifying sound waves and allowing fishes to perceive a far greater range of auditory stimuli (Moyle 2002).

Minnows occupy a wide variety of habitats and ecological niches. Some, such as speckled dace, are small, bottom oriented, and forage on algae and small invertebrates. Others, such as northern pikeminnow, are large predators that often hide in deepwater and prey on other fishes. Juveniles usually inhabit shallow channel edge and floodplain habitats as they grow. Many minnow species are tolerant of warm temperatures (Moyle 2002). For example, redside shiners thrive in water temperatures of up to 22°C (72°F) (Reeves 1984).

Suckers Habitat Use

The following species are in the sucker group and are found in the vessel corridor:

- Largescale sucker (*Catostomus macrocheilus*)
- Bridgelip sucker (*Catostomus columbianus*)
- Longnose sucker *(Catostomus catostomus)*

Suckers are generally found in clear, cold, deeper water of rivers and tributary streams as well as lakes. They usually spawn in stream habitat. Bridgelip suckers move into shallow, gravel-bottomed portions of streams to spawn while largescale suckers occupy pools in large or medium rivers for spawning. Most suckers feed on benthic invertebrates and algae (Scott and Crossman 1973).

Suckers occupy a wide variety of freshwater habitats. They are most common in rivers and streams. Adults feed on algae and invertebrates attached to the channel bottom. Spawning occurs in flowing water in the spring and summer. Juveniles feed and grow in floodplains, marshes, and shallow edge habitats.

Freshwater Sculpins Habitat Use

The following species are in the freshwater sculpin group:

- Prickly sculpin (*Cottus asper*)
- Coastrange sculpin (*Cottus aleuticus*)
- Mottled sculpin *(Cottus bairdi complex)*

Freshwater sculpin are small fishes that specialize in living at the bottom of swiftly flowing streams and rivers. Adults prey on invertebrates and fish eggs. Spawning occurs in flowing water during the spring and summer and larvae may drift downstream to the estuary.

Stickleback Habitat Use

One species of stickleback lives in the Columbia River:

- Threespine stickleback (*Gasterosteus aculeatus*)

Threespine stickleback are found in marine and freshwater habitats. They typically occupy still or slow-moving lowland streams and sheltered coastal waters. They are abundant in the Columbia River. Resident and anadromous forms are found in the Columbia River. They are not strong swimmers and usually inhabit slow-moving waters where they feed on small invertebrates among sediment, algae, and aquatic plants. They spawn on constructed nests at the bottom during the spring in fresh or brackish water (Wysoski and Whitney 2003).

Nearshore Fish

The nearshore fish are a diverse group of species characterized by their distribution in the nearshore ocean. The nearshore is defined as the area from the coastal high tide line offshore to the 30-fathom (180-foot or 55-meter) depth contour (ODFW 2006). The nearshore area includes a variety of habitats such as rocky shorelines, sandy beaches, rocky subtidal areas, soft bottom subtidal areas, and pelagic (open ocean) areas. Nearshore fishes can be broadly categorized into three groups: forage fish, surfperch, and pipefish. Each of these groups is discussed below.

Forage Fish Life History and Habitat Requirements

Forage fish are small, schooling fish that serve as an important source of food for other fish species, birds, and marine mammals. In addition, some species of forage fish are commercially and recreationally important. These species tend to have relatively short life spans and their populations experience great fluctuations in local abundance (Bargman 1998). Herring, smelt, anchovy, and sand lance are all considered forage fish throughout their life spans. Some species of predatory fish, such as mackerel and hake, are only considered forage fish at young ages (McClatchie et al. 2012). Young and small forage fish feed on phytoplankton and zooplankton, while larger individuals will also consume crustaceans and smaller fish. Almost all of the nearshore forage fish are strictly saltwater species. Some species of smelt, including the eulachon, have adopted an anadromous life cycle. The eulachon is a federally listed threatened species and is covered above in Protected Fish Species and Habitat Associations.

Some notable species of nearshore forage fish that could occur in the vessel corridor include (Lower Columbia Estuary Partnership 2010):

- Pacific herring (*Clupea pallasi*)
- Northern anchovy (*Engraulis mordax*)
- Surf smelt (*Hypomesus pretiosus*)
- Whitebait smelt (*Allosmerus elongatus*)
- Topsmelt (*Atherinops affinis*)
- Pacific sardine (*Sardinops sagax*)
- Pacific sand lance (*Ammodytes hexapterus*)
- Jack mackerel (*Tachurus symmetricus*)
- Pacific hake *(Merluccius productus)*

Most of the species listed above occur relatively close to the shoreline. Some species, like the Pacific sand lance, bury themselves in the sand of shallow shorelines. Others can be found schooling in large numbers in surface and mid-water habitats. Many species of forage fish have demersal eggs, which are laid in shallow water at sea. Some species, such as Pacific herring, surf smelt, and Pacific sand lance, spawn in shallow water along beaches.

Surfperch Life History and Habitat Requirements

Surfperch are almost exclusively saltwater fishes, although some individuals may occasionally enter the brackish water of estuaries. Surfperch inhabit shallow and intertidal areas along sandy or muddy shores, often adjacent to rocky bottom coasts. Most surfperch live in waters shallower than 100 feet (30 meters) deep. Surfperch are unique in that they bear large, fully developed live young rather than lay eggs. Female surfperch have a nearly 1-year-long gestation period after which they give birth to up to 40 newborn juvenile surfperch (Lamb and Edgell 1986). Several species of surfperch are found off the Washington and Oregon coasts. Surfperch feed on worms, mussels, shore crabs, razor clams, shrimps, snails, and clams. Schools of surfperch often congregate within 30 feet of the shoreline, darting in and out of the surf while foraging, making them popular targets of anglers (ODFW 2015).

Some species of surfperch that could occur in the vessel corridor include (Lamb and Edgell 1989, LCFRB 2010):

- Redtail surfperch *(Amphisticus rhodoterus)*
- Striped surfperch *(Embiotoca lateralis)*
- Pile perch *(Rhacochilus vacca)*
- Shiner perch *(Cymatogaster aggregata)*
- Striped seaperch *(Embiotoca lateralis)*
- White seaperch *(Phanerodon furcatus)*
- Silver surfperch *(Hyperprosopon ellipticum)*
- Kelp perch *(Brachyistius frenatus)*

Pipefish Life History and Habitat Requirements

Pipefish belong to the same family as seahorses. Pipefish have tiny, tubular bodies covered in a thin armor. Like seahorses, pipefish undergo internal fertilization and viable eggs are brooded by males. The bay pipefish (*Syngnathus griseolineatus*) is the only species that could occur within the vessel corridor. Bay pipefish are found in shallow water among marine plants, particularly eelgrass, which grow in shallow bays or around pilings. Bay pipefish glide slowly through the water feeding on tiny shrimp-like prey (Lamb and Edgell 1989). Bay pipefish are often found around wharves, but can also be found in tide lines.

Coastal Pelagic Species Life History and Habitat Requirements

CPS include northern anchovy, jack mackerel, Pacific sardine, Pacific (chub or blue) mackerel, and market squid. These species groups are discussed briefly (except northern anchovy) because they are unlikely to occur within habitats or in locations with a high probability of oil exposure. CPS can occur in shallow embayments or brackish water, but not to a significant degree. These water-column dwellers can generally be found anywhere from the surface to 1,006 meters (3,300 feet) deep and at significant distances offshore.

Jack mackerel and northern anchovy are part of the CPS Fisheries Management Plan. Along with market squid, they are considered monitored species (they do not need management by harvest guidelines or quotas according to the provisions of the management plan).

Nearshore coastal areas, bays, estuaries, and river mouths of Washington and British Columbia generally do not experience extensive use by these pelagic species, except for northern anchovy. Northern anchovy of all life-history stages are found in these areas and can be abundant, particularly during periods of warmer water in summer and fall. Increasing sea-surface temperatures related to climate change may shift the northern distribution of the spawning areas for the CPS, resulting in increasing frequency and abundances in juvenile use of Washington‘s nearshore coastal areas, or increased abundance in the offshore areas.

CPS are most common in the upper mixed layer of the ocean (above the thermocline) in a broad band (up to hundreds of miles wide) along the coast. CPS may occur in shallow embayments and brackish water but do not depend on these habitats to any significant degree. In general, older and larger individuals occur farther north and offshore. The northern extent of the distribution and EFH for CPS depends on temperature and biomass. Potential for occurrence of CPS for the rail and vessel corridors is described below.

Rockfish Life History and Habitat Requirements

The Pacific rockfishes consist of more than 60 species found off the California, Oregon, and Washington coasts (PFMC 2014). Rockfish are long-lived fish, with some individuals living to beyond 50 years. Some species of rockfish may mature as early as age 2, but it is more common for these species to take from 6 to 11 years to reach sexual maturity (Palsson et al. 2009). Larvae are found in surface waters and may be distributed over a wide area extending several hundred miles offshore. Larvae and small juvenile rockfish may remain in open waters for several months being passively dispersed by ocean currents. Juvenile rockfish "settling out" or recruiting[7] to nearshore habitats move along specific recruitment pathways that include many types and a succession of habitats. These recruitment pathways end at specific nursery habitats that are benthic, usually composed of rock substrate, and with abundant food resources.

A common approach to describing the diversity in community structure of rockfish assemblages is to categorize the species according to habitat water depth and substrate criteria. An example of community grouping of rockfish species by water-depth categories is presented in Table 3.6-4. Shifts in community composition can occur quite regularly along shoreline areas. For instance, at the same depth in the nearshore environment, communities will be vastly different depending on whether boulder habitat, kelp canopy, or unconsolidated bottom is dominant.

Table 3.6-4. Coastal Community Grouping of Rockfish Species by Water-Depth Categories

Rockfish Species	Nearshore	Shallow Shelf	Deep Shelf	Slope
Aurora				X
Black	X	X		
Blue	X	X		
Bocaccio	j	X	X	X
Canary		X	X	
China	X	X		
Copper	X	X		
Darkblotched			X	X
Greenstriped		X	X	X
Harlequin			X	X
Pacific Ocean perch			X	X
Puget Sound			X	
Pygmy		X	X	
Quillback	X	X		
Redbanded			X	X
Redstripe		X	X	X

7 Recruitment is the time when a young fish enters a fishery (i.e., becomes large enough to be caught) or enters a specific habitat such as juvenile or adult habitat (NOAA 2014d).

Table 3.6-4. Coastal Community Grouping of Rockfish Species by Water-Depth Categories

Rockfish Species	Nearshore	Shallow Shelf	Deep Shelf	Slope
Rosethorn		X	X	X
Rougheye			X	X
Sharpchin			X	X
Shortbelly			X	X
Shorttracker				X
Silvergray		X	X	X
Splitnose			j	j
Stripetail		j	X	
Tiger		X	X	X
Widow		X	X	
Yellowtail	X		X	
Yelloweye		X	X	X
Yellowmouth				X
Longspine thornyhead				X
Shortspine thornyhead				X

Source: Love et al. 2002.
j = juvenile fish

Variations and exceptions can occur when creating similar species groups or guilds for analyses. The rockfish community grouping is based on Love et al. (2002) (Table 3.6-4) and EFH general species descriptions and preferred habitat documentation (PFMC 2005a). It is a practical classification approach based on juvenile and larval stage habitat association that fits the goal of understanding the rockfish resource sensitivity to potential effects. The group is separated into the following three subsections for discussion and assessment purposes:

- Nearshore complex: the larval and juvenile life-history stages are strongly associated with nearshore habitats.
- Nearshore surface vegetation complex: pelagic larvae or juvenile life-history stages are strongly associated with algal mats or canopy.
- Offshore subsurface complex: larval or juvenile life-history stages are associated with offshore and subsurface.

Sharks, Skates, and Chimeras Life History and Habitat Requirements

This group includes sharks, skates, and chimaeras. Habitat associations are presented in Table 3.6-5.

Soupfin sharks form dense shoals and have a coastwide movement that is not completely understood. The soupfin migrates north in summer and southward in winter. During the late 1930s and the 1940s, the soupfin shark was one of the most economically important of the sharks on the West Coast. Currently, most catches are made as bycatch in other commercial fisheries or by recreational fishers.

Table 3.6-5. Vertical Distribution and Ecological Zone Categories for Sharks, Skates, and Chimaeras

Common Name	Scientific Name	Larvae	Juvenile	Subadult/Adult	Complex*
Soupfin	*Galeorhinus galeus*	Nearshore	Nearshore to deep shelf Benthopelagic	Nearshore to deep shelf Benthopelagic	Shark
Spiny dogfish	*Squalus acanthias*	Nearshore	Nearshore to deep shelf Benthopelagic	Nearshore to deep shelf Benthopelagic	Shark
California skate	*Raja inornata*	Egg: estuary and deep shelf Demersal	Estuary and deep shelf Demersal	Estuary and deep shelf Demersal	Skate
Longnose skate	*Raja rhina*	Egg: Demersal	Nearshore to deep shelf Demersal	Nearshore to deep shelf Demersal	Skate
Big skate	*Raja binoculata*	Egg: Shallow shelf Demersal	Shallow shelf to continental slope Demersal	Shallow shelf to continental slope Demersal	Skate
Spotted ratfish	*Hydrolagus colliei*	None	Nearshore to deep shelf Demersal	Nearshore to deep shelf Demersal	Chimaera

Sources: McCain et al. 2005, NMFS website (http://www.nmfs.noaa.gov).

Notes:

Vertical distribution categories include surface, subsurface, epipelagic, and mesopelagic.

Coastal ecological zones include nearshore, shallow shelf, deep shelf, and continental slope.

* Species complexes are subgroups of species with similar distributions and life-history patterns.

Spiny dogfish often migrate in large schools and feed avidly on their journeys. They undertake seasonal migrations to stay in the preferred temperature range. Schooling behavior occurs with inshore populations and with migratory offshore populations. Spiny dogfish are currently the most abundant and economically important shark off North American coasts.

Big skates can be found in waters from the intertidal range to depths of 120 meters (394 feet), inhabiting the coast in estuaries, bays, and over the continental shelf. Big skates are commonly found on sandy and muddy bottoms where they hide with only eyes protruding, although they are also sometimes observed in low stands of kelp. Big skates are generally taken as bycatch in other fisheries and occasionally are taken by recreational fishers.

The spotted ratfish, which is a chimera, makes significant seasonal migrations. In winter, spotted ratfish move into shallow nearshore waters and estuaries, probably for feeding and prespawn mate selection. The northeastern Pacific has no directed fishery for spotted ratfish, but they are taken quite often as bycatch in bottom trawls. Spotted ratfish are not sought by recreational fishers but are caught occasionally while fishing for other demersal species (PFMC 2005b).

Flatfish Life History and Habitat Requirements

The flatfish are a group of species characterized by a demersal adult life-history stage, they have a compressed form with both eyes facing upwards on the same side of the body. Juveniles and adults orient themselves parallel to the substrate while lying flat or swimming, and most species typically prefer sand and mud substrates.

Adults of various species make limited to long migrations. In spring to summer, migratory adults move to shallower feeding grounds, then often spend winters in the deeper waters of their depth ranges. Spawning timing varies greatly by species, but many spawn in the winter. Spawning occurs over soft-bottom mud substrata at depth. Most species' eggs are buoyant, but some are neutrally buoyant, and few sink. Eggs and larvae are pelagic, and some species' larvae make vertical diel migrations in the water column. Larvae metamorphose from a pelagic upright swimming form to the demersal juvenile flat, side swimming form prior to settlement. Juvenile settlement and rearing areas vary across species and include deep and shallow continental slope, nearshore, and estuarine areas. Larvae of most species are planktivorous; juveniles and adults are typically carnivorous feeding on invertebrates and other fishes. Larger fishes, birds, and marine mammals feed on various flatfishes.

Commercial and recreational fisheries exist for various flatfishes. Pacific halibut, the largest of the flatfishes, are heavily targeted. English sole, starry flounder, sand sole, and Pacific sanddab form a nearshore, mixed-species flatfish assemblage and fishery. Other commercially important species include petrale sole, Dover sole, and arrowtooth flounder.

Flatfishes in the vessel corridor are separated into two subgroups. A summary of each subgroup's general habitat utilization, by life-history stage, is provided in Table 3.6-6:

- **English sole subgroup.** The larval and juvenile life-history stages are strongly associated with surface waters and estuarine nursery areas.
- **Arrowtooth flounder subgroup.** Fish with larvae and juveniles can rear in relatively deeper waters and the distributions of those life-history stages are farther offshore—in shallow to deep shelf and sometimes continental slope areas.

English Sole Subgroup Habitat Use

The following species are in the English sole group:

- English sole *(Pleuronectes vetulus)*
- Butter sole *(Pleuronectes isolepis)*
- Dover sole *(Microstomus pacificus)*
- Flathead sole *(Hippoglossoides elassodon)*
- Sand sole *(Psettichthys melanostictus)*
- Starry flounder *(Platichthys stellatus)*
- Rock sole *(Lepidosetta bilineata)*
- C-O sole *(Pleuronichthys coenosus)*
- Speckled sanddab (*Citharichthys stigmaeu*)
- Pacific sanddab *(Citharichthys stigmaeus)*

The English sole group is comprised of flatfish with similar life-history-stage characteristics and habitat use—eggs float at or near the surface in the nearshore to deep shelf regions, and larvae and juveniles are often strongly associated with estuarine habitats.

Table 3.6-6. Flatfish Use of the Project Vicinity and Vessel and Rail Corridors in Washington

Group	Subgroup	Occurrence in Study Area by Life-History Stage			Habitat Use by Life Stage				Comments
		Vessel Corridor	Project Vicinity	Rail Corridor	Eggs	Larvae	Juvenile	Subadult and Adult	
Flatfishes	English sole subgroup	Eggs, larvae, juveniles, adults likely present	Not present; except for starry flounder – low likelihood of occurrence	Not present	Estuaries, nearshore, and shallow shelf. Surface	Nearshore to Epipelagic	Estuaries, intertidal, out to shallow continental slope	Estuaries to deep shelf, most common in water less than a few hundred feet deep.	Adult starry flounder sometimes spawn in estuaries. Juveniles are very freshwater tolerant, and have been found 75 miles up the Columbia River from the ocean. Starry flounder, sand sole, Pacific sanddab, and English sole form a nearshore, mixed-species flatfish assemblage and fishery.
Flatfishes	Arrowtooth flounder subgroup	Juveniles, adults low likelihood of occurrence	Not present	Not present	Shallow shelf to continental slope. Epi- to mesopelagic.	Continental shelf. Epi- to mesopelagic.	Shallow to deep shelf	Shallow shelf to continental slope	Adults make inshore feeding – offshore spawning migrations from summer to winter. Dover sole and petrale sole are major commercial fisheries. A small targeted fishery has emerged for arrowtooth flounder in the northern Pacific.

Arrowtooth Flounder Subgroup Habitat Use

The Arrowtooth flounder group consists of species that occur almost exclusively in euhaline waters of the outer continental shelf and upper continental slope. Eggs and larvae typically occur in epipelagic or mesopelagic depth. The distributions of most life stages are farther offshore than the English sole group, in the shallow and deep shelf ecological regions. Some species of this group utilize continental slope areas, and most exhibit a strong migration from shallow-water summer feeding grounds to winter deepwater spawning grounds. Juveniles are not associated with estuarine areas.

The following species are in the arrowtooth flounder group:

- Arrowtooth flounder (*Atheresthes stomias*)
- Pacific halibut (*Hippoglossus stenolepis*)
- Slender sole (*Lyopsetta exilis*)
- Petrale sole (*Eopsetta jordani*)
- Rex sole (*Glyptocephalus zachirus*)
- Curlfin sole (*Pleuronichthys decurrens*)

All life-history stages of species in the Arrowtooth flounder group are predominantly found on the continental outer shelf and continental slope. However, some occurrence records exist of adults of these species in waters off of the Columbia River mouth, although at depths below those found within 3 miles of the river mouth (MEC Analytical Systems, Inc. and Science Applications International Corp, as cited in Pearcy 2005).

3.6.2.3 Marine Mammals

Thirty-four marine mammal species have the potential to occur in Washington waters (Tables 3.6-7 and 3.6-8). These species include 29 cetaceans (whales, dolphins, and porpoises), and 5 pinnipeds (seals and sea lions). Information was obtained from NMFS North Pacific Marine Mammal Stock Assessment Reports, various recovery plans, technical reports, scientific publications, and the National Marine Mammal Laboratory in Seattle.

The prominent inland water species in the Lower Columbia River are the harbor seal, California sea lion, and Steller sea lion. These species utilize haulout (resting) sites within the Columbia River. These pinnipeds would be expected to occur within the proposed Facility, and rail corridor, and vessel corridor study areas, as they are known to follow prey species upstream as far as Bonneville Dam. Whales, dolphins, and porpoises are only associated with the marine environment and would be expected to occur at the end of the vessel corridor when vessels are leaving the Columbia River mouth and entering the marine environment.

Protected Mammal Species

Seven federally listed cetaceans (whales, dolphins, and porpoises) and two state-listed cetaceans have the potential to occur in the study areas (Table 3.6-7). While some whales can be found off the Washington coast throughout the year, most tend to feed during the summer months at northern latitudes and then migrate south for winter breeding, with the exception of killer whales, which can be found in marine waters year-round In general, marine mammal sightings are more common along the continental shelf and slope, except for sei and sperm whales, which have a more oceanic distribution and are more common at deeper depths.

All marine mammals listed as threatened or endangered under the ESA are protected under the MMPA.

Table 3.6-7. Special-Status Marine Mammals within the Project Vicinity and Vessel and Rail Corridors in Washington

Common Name	Scientific Name	Federal[a]	State Status[b]	Occurrence within Study Area[c]		
		ESA / SSS Status	WA / OR	Project Vicinity	Vessel Corridor	Rail Corridor
Cetaceans						
Blue whale	*Balaenoptera musculus*	FE	WA-SE / OR-SE		Uncommon	
Gray whale	*Eschrichtius robustus*	None	WA-SS / OR-SE		X	
Humpback whale	*Megaptera novaeangliae*	FE	WA-SE / OR-SE		Uncommon	
Fin whale	*Balaenoptera physalus*	FE	WA-SE / OR-SE		X	
North Pacific right whale	*Eubalaena japonica*	FE	WA-SE		Uncommon	
Southern resident killer whale	*Orcinus orca*	FE	WA-SE		X	
Sei whale	*Balaenoptera borealis*	FE	WA-SE / OR-SE		Uncommon	
Sperm whale	*Physeter macrocephalus*	FE	WA-SE / OR-SE		X	
Dall's porpoise	*Phocoenoides dalli*	None	WA-SM		Uncommon	
Harbor Porpoise	*Phocoena*	None	WA-SC	X	X	
Pinnipeds						
Harbor seal	*Phoca vitulina richardii*	None	WA-SM	X	X	X
Steller sea lion (eastern DPS)[d]	*Eumetopias jubatus*	Delisted (2013)	WA-ST	X	X	X
Northern sea otter	*Enhydra lutris kenyoni*	FT	WA - SE		Uncommon[e]	

Sources: WDFW 2012, ODFW 2014, NMFS 2015, Wiles 2015

a Endangered Species Act Classifications: FE = Federal Endangered, FT = Federal Threatened, FC = Federal Candidate

b State Status: WA = Washington, OR = Oregon, SE = State Endangered, ST = State Threatened, SC = State Candidate, Sco = State Concern, SS = State Sensitive, SM = State Monitored

c The 1-mile rail and Mid-Columbia River corridors overlap; occurrences are repeated within each corridor where corridors overlap.

d The Eastern DPS of Steller sea lion was federally delisted in 2013. The species is still state listed in Washington; however, the WDFW has recommended that it be delisted at the state level in Washington.

e The northern sea otter was surveyed by WDFW in 2012, and the southernmost animals were observed near Cape Elizabeth, which is over 70 miles north of the Columbia River.

Blue Whale

The eastern North Pacific population of blue whales feed in California waters in summer/fall (from June to November) and migrate south to productive areas off Mexico in winter (Carretta et al. 2007). More recently, sightings have occurred off the Oregon, Washington, and British Columbia coasts (Calambokidis et al. 2009). Historically, blue whales were not common along the Washington coast; however, they did occasionally occur (Calambokidis et al. 2004). Vessel surveys conducted in Washington waters in 1996 and 2001 did not detect the presence of blue whales (Carretta et al. 2013). Consequently, although they may occur in the vessel corridor, blue whale occurrences are expected to be uncommon in the vessel corridor (Calambokidis et al. 2009). Blue whales do not occur in the Project vicinity or along the rail corridor. They may occur in oceanic areas of the vessel corridor; however, occurrence in the vessel corridor would be uncommon.

Gray Whale

Gray whales are one of the most studied whales, resulting in an extensive understanding of their migration and general ecology. The estimated carrying capacity for the North Pacific gray whale is 22,000 and the current population is 19,126 animals; therefore, the population is currently at or near carrying capacity (Rugh et al. 2001, Wade and Perryman 2002, Carretta et al. 2013).

Gray whales seasonally migrate between summer feeding grounds in the Bering and Chukchi seas and winter breeding grounds in the lagoons in Baja, California (Rugh et al. 1999, 2001). The southward migration can occur off Washington beginning as early as November; however, recent studies indicate that gray whales begin their southward migration in early December, peaking on or about January 5 and ending in the first week of February (Rugh et al. 2001). During their migration, gray whales move past Washington in a wide corridor extending from nearshore to over 47 kilometers (29 miles) offshore, with a mean distance of approximately 24 kilometers (15 miles) from shore (Green et al. 1995, Shelden et al. 2000). The southbound migration is segregated by age, sex, and reproductive status (Rice and Wolman 1971); near-term pregnant females lead the migration, followed by oestrus (sexually receptive) females and mature males, and then immature animals of both sexes.

The northward migration off the Washington coast occurs from February through June, with females and calves dominating the migration in June. The northward migration corridor is narrower than the southward and extends from nearshore to over 19 kilometers (12 miles) offshore with a mean distance of approximately 11 kilometers (7 miles), indicating that most northbound whales migrate closer to shore and in a narrower band than southbound whales (Braham 1984, Darling 1984, Brueggeman et al. 1992, Green et al. 1995). The northward migration occurs in two distinct phases segregated according to age, sex, and reproductive condition (Poole 1984, Swartz 1986). The first phase includes newly pregnant females, followed by adult males, anestrous (sexually inactive) females, and immature whales of both sexes.

Gray whales are predominantly bottom feeders, preying on small invertebrates and crustaceans (Nerini 1984); they feed primarily on large aggregations or patches of benthic amphipods (Nerini 1984). Gray whales have been observed feeding off Vancouver Island on amphipod and mysid crustaceans and feeding on ghost shrimps off the Washington coast (Murison et al.1984, Weitkamp et al. 1992).

Most eastern North Pacific gray whales summer in the Bering Sea and in the adjacent waters of the Arctic Ocean, but some remain in Washington waters to feed from late spring into fall (Calambokidis et al. 2002). Most whales occur off the coast. Cow–calf pairs have not been recorded outside of the migration periods in Washington, indicating that most whales summering in the region are nonbreeding.

Gray whales do not occur in the Project vicinity or rail corridor. However, they may occur in oceanic areas of the vessel corridor.

Humpback Whale

Humpback whales occur in oceans worldwide where they undertake migrations between northern temperate latitudes for feeding and tropical/subtropical latitudes for giving birth. They feed primarily near the surface on krill, small fish, and other planktonic organisms. Near Oregon and Washington they are usually seen several miles offshore. They are well known for elaborate communication "songs" and displays of slapping and breaching.

Humpback whales do not occur in the Project vicinity or rail corridor. They may occur in oceanic areas of the vessel corridor; however occurrence in the vessel corridor would be uncommon, as humpback whales prefer deep, offshore waters, which occur outside of the vessel corridor.

Fin Whale

Fin whales are year-round residents off the California coast, are summer residents off the Oregon coast, and possibly pass through Washington waters. Aerial surveys conducted by Brueggeman et al. (1992) off the Oregon and Washington coasts observed 13 groups of 27 fin whales between June and January. All of the fin whales were observed in Oregon waters and all but 5 whales in waters were found on the continental slope in waters depths from 200 to 2,000 meters (656 to 6,562 feet). The whales not observed in continental slope waters included 2 whales approximately 200 kilometers (124 miles) offshore in November and 3 whales on the continental shelf just south of the Columbia River in January. The former group was traveling south, suggesting that they were migrating back to wintering grounds. Except for these two groups, all of the other whales were observed during June and July. No calves were observed with any of the whales. Green et al. (1993) reported sighting two fin whales during aerial surveys off Oregon and Washington between March and May in 1992, but did not report the location. An estimated 2,636 fin whales occur off California, Oregon, and Washington coasts during summer/fall based on shipboard surveys in 2001 and 2005 (NMFS 2010).

Fin whales do not occur in the Project vicinity or rail corridor. They may occur in oceanic areas of the vessel corridor.

North Pacific Right Whale

The North Pacific right whale is a baleen whale that occurs in the North Pacific Ocean. They feed on small planktonic organisms such as copepods near the ocean surface. Feeding occurs primarily in the Bering Sea in summer and breeding occurs in warm coastal subtropical waters of the southeastern Pacific during the winter. Occurrences of this species off the Washington and Oregon coasts are thought to be migratory. North Pacific right whales were historically the target of intensive whaling and are thought to be greatly reduced from historical numbers.

North Pacific right whales do not occur in the Project vicinity or rail corridor. They may migrate through oceanic areas of the vessel corridor; however occurrence in the vessel corridor would be uncommon.

Southern Resident Killer Whale

The southern resident killer whale population is a transboundary population comprised of about 80 animals split among three pods (J, K, and L) that are considered one stock under the MMPA and a DPS under the federal ESA. The southern resident stock is differentiated from the northern and southern Alaska resident stocks, which do not inhabit waters off Washington. The southern resident killer whale pods frequently feed along the British Columbia, Washington, and Oregon coasts and are sometimes seen as far south as Southern California. Southern resident killer whales feed primarily on fish. Although these whales prefer Chinook salmon, they also consume other salmonids and groundfish, such as halibut and lingcod. Fraser River Chinook make up the bulk of the whales' summer diet while they are in the Salish Sea; however, the whales also travel down the coast to feed on migrating Chinook from the Columbia, Sacramento, Klamath, and other coastal rivers (NOAA 2014c).

Southern resident killer whales do not typically occur in the Project vicinity, although they have on rare occasions traveled upstream in the Columbia River as far as Portland, Oregon (Wilson 2015a). They do not occur in the rail corridor. However, they are known to feed along the Washington and Oregon coasts, particularly in the Columbia River plume during yearly Chinook runs (Wilson 2015b). They are likely to occur in the marine portion areas of the vessel corridor study area and within the Columbia River plume.

Sei Whale

The Sei whale is a large baleen whale that occurs in deep offshore waters worldwide. Sei whales feed on krill and other planktonic organisms near the ocean surface. Feeding occurs largely in cool temperate waters in summer and breeding occurs in warm subtropical waters during the winter.

Sei whales do not occur in the Project vicinity or the rail corridor. They may occur in oceanic areas of the vessel corridor, but would be uncommon since they are found in depths that occur outside the vessel corridor study area.

Sperm Whale

Sperm whales inhabit deep oceanic waters worldwide where they dive to great depths in pursuit of giant squid (*Architeuthis* sp.), their primary prey. Nonbreeding males are generally solitary but females and juveniles tend to travel in groups. Birthing and rearing of young tends to occur at lower temperate latitudes. The species occurs closer to shore in areas where canyons and other features provide deep habitat near the continental shelf. Sperm whales were historically the target of intensive whaling.

Sperm whales do not occur in the Project vicinity or rail corridor. They may occur in oceanic areas of the vessel corridor.

Dall's Porpoise

Dall's porpoises are common in Washington's inland and coastal waters and are probably the most widely distributed cetacean in the temperate and subarctic regions of the North Pacific and Bering Sea (Carretta et al. 2004). An estimated 57,549 Dall's porpoises occur in the California, Oregon, and Washington stock (Carretta et al. 2007). Brueggeman et al. (1992) reported 152 groups of 341 Dall's porpoise, including 4 calves, during surveys off Oregon and Washington. Porpoise were most common during fall, lowest during winter, and intermediate during spring and summer—although encounter rates were not substantially different among seasons, suggesting that a resident population occurs off Oregon and Washington. Encounter rates were highest over the continental slope, lowest on the continental shelf, and intermediate in offshore waters. They rarely occurred in shallow coastal waters.

Dall's porpoises do not occur in the Project vicinity or rail corridor. They may occur in the intermediate offshore oceanic areas of the vessel corridor; however occurrence in the vessel corridor would be uncommon because this area is not highly used by this species.

Harbor Porpoise

Harbor porpoises are common year-round residents off the coast and within Washington's inland waters. An estimated 10,682 harbor porpoises occur in Washington's inland waters, and 37,745 occur off the Oregon and Washington coasts (Carretta et al. 2007). Harbor porpoise abundance is particularly high in fall and winter, low in summer, and intermediate in spring (Brueggeman et al. 1992, Carretta et al. 2004). While abundances vary seasonally, harbor porpoises do not appear to be migratory (NMFS 1992). They are widespread throughout Washington's inland and coastal waters (NMFS 1992).

Scheffer and Slipp (1948) provide a historical account of this species in Washington. Harbor porpoises are known to calf and breed in Washington and, generally, give birth in summer from May through July. Calves remain dependent on their mothers for at least 6 months (Alaska Department of Fish and Game 2008). Their primary prey is small fish and squid, including herring (Leatherwood and Reeves, as cited in Haley 1978). Because harbor porpoises are usually shy and avoid vessels, they are difficult to approach. The species frequents inshore areas, shallow bays, estuaries, and harbors. They are found almost exclusively shoreward of the 100-fathom (600-foot) contour line along the Pacific coast, with the vast majority found inside the 25-fathom (150-foot) curve (Green et al. 1992).

Harbor porpoises may occur in the Project vicinity and are expected to occur in the vessel corridor, but are not found in the rail corridor.

Norther Sea Otter

Sea otters use a variety of nearshore marine environments, but are generally associated with rocky substrates supporting kelp beds, Kelp canopy is an important habitat component, used for foraging and resting (Doroff & Burdin 2015). Sea otters do not occur in the Project vicinity or the rail corridor. They may occur in the vessel corridor, but this would be uncommon, as the southernmost observations by WDFW are 70 miles north, near Cape Elizabeth (WDFW 2012).

Non-Special-Status Marine Mammals in the Study Areas

Fifteen cetaceans and three pinnipeds have the potential to occur in the study areas (Table 3.6-8). Of these, only five of the cetaceans and the three pinnipeds would be expected to occur with any regularity. These eight species are discussed in more detail below. The other 10 identified in Table 3.6-8 would be uncommon in the vessel corridor are discussed under Uncommon Marine Mammals.

The occurrence of cetacean species would generally be limited to marine portions of the waterway. Northern fur seals and elephant seals are occasionally sited in and near the Columbia River; however, they do not occur in large numbers or for very long (Jefferies et al. 2000, NMFS 2006). Large numbers of California sea lions and harbor seals can be found using haulout sites along the Lower Columbia River.

Biggs Killer Whale (Transient Killer Whale)

Transient killer whales (also known as Biggs killer whales) are a distinctive race and have subtle physical characteristics that differentiate them from the endangered southern residents described previously. Transients are highly migratory opportunistic predators that occur along the West Coast from Alaska to California. Their range overlaps with that of the southern resident killer whales. Transient killer whales travel in stable long-term groups and feed primarily on other marine mammals, including seals, sea lions, porpoises, minke whales, and the calves of larger whales such as grey whales, in contrast to southern residents that feed primarily on fish (NOAA 2015b). Transient killer whales could occur in the vessel corridor study area at the mouth of the Columbia River estuary, as well as over the continental shelf where they would hunt marine mammal prey that are abundant in the area. They do not occur in the Project vicinity or the rail corridor.

Minke Whale

Minke whale surveys (2001 and 2005) off the California, Oregon, and Washington coasts have estimated the population at approximately 898 whales (Carretta et al. 2007). Minke whales reside off the Washington coast year-round (Carretta et al. 2007). They typically occur as single animals rather than in groups. Brueggeman et al. (1992) encountered four single minke whales, including three off the Oregon coast and one off the Washington coast. Most were on the continental shelf. Minke whales are also known to enter shallow bays and estuaries (NMFS 2012a). Green et al. (1993) reported 10 groups of 12 minke whales off the Oregon and Washington coasts between March and May, but did not give their locations or distributions between the two states. Minke whales typically prey on small fish and squid (NMFS 2012a). They do not occur in the proposed Project vicinity or rail corridor, but may occur in oceanic areas of the vessel corridor.

Table 3.6-8. Nonspecial-Status Marine Mammals within the Project Vicinity and Vessel and Rail Corridors in Washington

Common Name	Scientific Name	Occurrence within Corridors[a]		
		Project Vicinity	Vessel Corridor	Rail Corridor
Cetaceans				
Biggs Killer Whale (Transient Killer Whale)	*Orcinus orca*		X	
Minke whale	*Balaenoptera acutorostrata scammoni*		X	
Northern right whale dolphin	*Lissodelphis borealis*		X	
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*		X	
Risso's dolphin	*Grampus griseus*		X	
Short-beaked common dolphin	*Delphinus delphis*		uncommon	
Striped dolphin	*Stenella coeruleoalba*		uncommon	
Common bottlenose dolphin	*Tursiops truncates truncatus*		uncommon	
False killer whale	*Pseudorca crassidens*		uncommon	
Short-finned pilot whale	*Globicephala macrorhynchus*		uncommon	
Pygmy sperm whale	*Kogia breviceps*		uncommon	
Dwarf sperm whale	*Kogia sima*		uncommon	
Baird's beaked whale	*Berardius bairdii*		uncommon	
Cuvier's beaked whales	*Ziphius cavirostris*		uncommon	
Mesoplodont beaked whales (6 species)	*Mesoplodon* spp.		uncommon	
Pinnipeds				
California sea lion	*Zalophus californianus*	X	X	X
Northern elephant seal	*Mirounga angustirostris*	X	X	X
Northern fur seal	*Callorhinus ursinus*	X	X	
Harbor seal[b]	*Phoca vitulina richardii*	X	X	X
Steller sea lion (eastern DPS)	*Eumetopias jubatus*	X	X	X

Notes:

a The 1-mile rail and Mid-Columbia River corridors overlap; occurrences are repeated within each corridor where corridors overlap.

b Washington State Monitored Species

DPS = distinct population segment

Northern Right Whale Dolphin

The California, Oregon, and Washington stock of the northern right whale dolphin is estimated at 20,362 animals (Carretta et al. 2004). It is relatively common off the Washington coast, which is toward the northern end of its range in the eastern North Pacific Ocean (Brueggeman et al. 1992), and has been reported in Washington waters during all seasons except winter (Brueggeman et al. 1992). Abundance of northern right whale dolphins is highest in fall and lowest during spring and summer. Northern right whale dolphins' use of the slope waters is considerably higher than in the offshore water, and few dolphins occur in shelf waters. While northern right whale dolphins show a seasonal abundance pattern off Washington that is somewhat opposite that in California, it is not clear if they move between the two areas. The primary prey for this species is fish and squid. The northern right whale dolphin has been frequently reported in association with Pacific white-sided dolphins (Leatherwood and Walker 1979, Brueggeman et al. 1992). They do not occur in the Project vicinity or along the rail corridor, but may occur in oceanic areas of the vessel corridor.

Pacific White-Sided Dolphin

The Pacific white-sided dolphin population is estimated at 25,233 animals for the California, Oregon, and Washington stock and is one of the most abundant dolphins occurring year-round off the Washington coast (Brueggeman et al. 1992, Green et al. 1993, Carretta et al. 2007). Seasonal habitat shifts occur off Oregon and Washington, where dolphins are more common in offshore waters during spring and shift to slope waters during summer and fall, in rough synchrony with the movements of prey (Van Waerebeek 2002). Also, seasonal north-south movements of Pacific white-sided dolphins may occur (Forney and Barlow 1998). Peak abundance of the Pacific white-sided dolphin off the Oregon and Washington coasts has been reported during May (Brueggeman et al. 1992, Buckland et al. 1993). Pacific white-sided dolphins consume a wide variety of fishes and cephalopods. Off British Columbia, Canada, herring was the most commonly occurring prey species, followed by salmon, cod, shrimp, and capelin (Heise 1997). Pacific white-sided dolphins have been known to occur in association with other marine mammals, including Dall’s porpoise, Risso’s dolphin, northern right-whale dolphin, humpback whale, and gray whale (Brueggeman et al. 1992).

Pacific white-sided dolphins do not occur in the Project vicinity or along the rail corridor, but they may occur in oceanic areas of the vessel corridor.

Risso’s Dolphin

The Risso’s dolphin population for the California, Oregon, and Washington stock is at 12,093 animals (Carretta et al. 2007). Risso’s dolphins are common off the Washington coast, where they are present year-round (Brueggeman et al. 1992). They are most common during spring and summer, lowest in winter, and intermediate in fall (Brueggeman et al. 1992). Calves have been observed off Oregon and Washington during May, July, and November. Risso’s dolphins primarily inhabit slope waters, but they also occur in lower numbers near the edge of the continental shelf. Risso’s dolphins consistently are found in the continental slope and shelf edge waters throughout the year, suggesting no inshore-offshore movement pattern. However, some seasonal north-south movement of Risso’s dolphins may occur between Oregon/Washington and California based on the shifts in abundance between the two regions, possibly related to prey movements. Their prey mainly includes cephalopods and fish (NMFS 2012b). Risso’s dolphins have been known to occur in association with other marine mammals, including Pacific white-sided and northern right whale dolphins (Brueggeman et al. 1992). They do not occur in the Project vicinity or along the rail corridor, but may occur in oceanic areas of the vessel corridor.

California Sea Lion

The California sea lion occurs seasonally in Washington waters (NMFS 1992). The total population is estimated at 296,750 sea lions and growing at 5.4 percent per year (Carretta et al. 2013). Of this total, an estimated 3,000 to 5,000 occur in Washington and British Columbia (Jeffries et al. 2000). Males migrate northward along the coast following the summer breeding season in California. Beginning in August, California sea lions appear along the outer Washington coast, and some move into Puget Sound and into British Columbia. California sea lions remain in Washington waters through the winter and early spring before returning to California in May and June. The migration can be characterized as a feeding migration, consisting primarily of adult and subadult males. California sea lion females and younger animals less than 4 to 5 years old tend to remain near their home rookeries throughout the year, or move only as far north as central California. Their main diet includes anchovies, sardine, whiting, mackerel, rockfish, and market squid (National Marine Mammal Laboratory 2013a). They prey on salmon seasonally and may pursue them as far upriver as Bonneville Dam. (Maps of haulout sites are available at the WDFW website: http://wdfw.wa.gov/publications/00427/wdfw00427.pdf.) California sea lions may occur in the Project vicinity, along the rail corridor, or in the vessel corridor.

Northern Elephant Seal

Northern elephant seals, estimated to number 124,000 animals, breed off Mexico and California during winter, and move northward to feed from Baja California to northern Vancouver Island and far offshore of the Gulf of Alaska and Aleutian Islands (Carretta et al. 2013). Solitary seals are occasionally recorded in Washington's inland waters. Brueggeman et al. (1992) encountered elephant seals off the Washington coast primarily during summer and early fall, but none in spring. Most of the elephant seals they encountered were over the continental shelf and slope, at a mean distance of almost 64 kilometers (40 miles) from the coast. Elephant seals prey on deepwater and bottom-dwelling organisms, including fish, squid, crab, and octopus (National Marine Mammal Laboratory 2013b). Northern elephant seals may occur in the Project vicinity, along the rail corridor, or in the vessel corridor.

Northern Fur Seal

The Eastern Pacific stock of the northern fur seal, estimated to number 611,617,935 animals, is a seasonal migrant off the Washington coast (Angliss and Outlaw 2008, Carretta et al. 2013). The species does not breed in Washington; the closest rookeries are in the Bering Sea and the Channel Islands of California. During the breeding season in summer months, most of the population is found on the Pribilof Islands in the southern Bering Sea. Females and juveniles of both sexes migrate south into waters over the continental shelf and slope of the eastern North Pacific Ocean, while adult males stay in Alaska waters. The migration ranges as far south as 30 to 32 degrees north latitude off Southern California and northern Baja, Mexico. Fur seals begin their return migration northward in mid-spring; by early summer, most have returned to their breeding islands. They feed on pollock, herring, capelin, squid, and small schooling fishes (Alaska Department of Fish and Game 2008). In Washington, Brueggeman et al. (1992) reported that northern fur seals primarily inhabited the deep offshore waters, but they also use shelf and slope waters. They have been observed off Washington year-round, but most (more than 90 percent) have been encountered from January through May. Northern fur seals may occur in the project vicinity but not along the rail corridor. They are expected to occur in the vessel corridor.

Harbor Seal

The harbor seal is the most common marine mammal in Washington (NMFS 1992), with a stable population that numbers 10,430 seals off the Washington coast (Carretta et al. 2004, 2007). The species occurs year-round in Washington. Females produce one pup per year, beginning at age 4 or 5. Common prey includes sole, flounder, sculpin, hake, cod, herring, squid, octopus and, to a much lesser degree, salmon (Newby as cited in Haley 1978). They utilize the Columbia River estuary for feeding and haulout sites. (Maps of haulout sites are available at the WDFW website: http://wdfw.wa.gov/publications/00427/wdfw00427.pdf.) Harbor seals may occur in the Project vicinity, along the rail corridor, and in the vessel corridor.

Steller Sea Lion

The Steller sea lion occurs year-round in Washington, with peak numbers (approximately 1,000 animals) in late summer, fall, and winter (Jeffries et al. 2000). The species does not breed in Washington; the closest rookeries are in northern British Columbia and central Oregon, where pupping occurs in May and June. Within Washington waters, Steller sea lions occur primarily along the outer coast, with smaller numbers in the inside waters of the Strait of Juan de Fuca and Puget Sound. Steller sea lion haulout sites tend to be located on exposed rocky shorelines and wave-cut platforms (NMFS 2008a), including areas in the Columbia River estuary. (Maps of haulout sites are available at the WDFW website:

http://wdfw.wa.gov/publications/00427/wdfw00427.pdf.) Steller sea lions may occur in the Project vicinity, along the rail corridor, or in the vessel corridor.

Uncommon Marine Mammals in the Vessel Corridor

Fifteen species of nonlisted[8] marine mammals are uncommon or rare in Washington waters. These include eight species of toothed whales (Baird's and Curvier beaked whales), six species of mesoplodont beaked whales (Blainville's, Perrin's, Lesser, Stejneger's, Gingko-toothed, and Hubb's beaked whales), four species of baleen whales (false killer, short-finned pilot, pygmy sperm, and dwarf sperm whales), and three species of dolphins (short-beaked common, striped, and common bottlenose dolphins) (Carretta et al. 2014). Most of these species would be expected to occur seasonally, in low numbers, or in deeper offshore waters outside the vessel corridor. Brueggeman et al. (1992) observed a small number of false killer whales in spring and beaked whales in fall off the Washington coast. Five groups of Baird's beaked whales (totaling 21 whales) also were observed, but all were off the Oregon coast during spring and summer, suggesting low occurrence of this species in Washington waters. Some limited information is available on this group of uncommon marine mammals, but little is known about their use of waters off the Washington coast. These species would not be expected to occur in the vessel corridor.

Vocalizations and Hearing in Marine Mammals

Sound travels much farther underwater than in air, and the sounds produced by many marine mammals can project for miles (URI 2013). Some marine mammals rely on echolocation to aid in navigation and hunting within their environment. Echolocation involves the emission of sound and the reception of its echo, which allows the animal to gather information about objects and prey around them, including their range and configuration. Therefore, it is important to understand marine mammal vocalizations and hearing to assess the potential effects of vessels traveling to and from the proposed Facility on whales and dolphins.

Toothed Whales

Toothed whales use echolocation to detect the size and nature of objects in their environment. Killer whales produce a wide variety of clicks, whistles, and pulsed calls. Their clicks are relatively broadband and short (0.1 to 25 milliseconds); the clicks range in frequency from 8 to 80 kiloHertz (kHz), with an average center frequency of 50 kHz and an average bandwidth of 40 kHz (Au et al. 2004). Studies of other toothed whales (dolphins and porpoises) found that the most sensitive frequencies were between 8 and 90 kHz (Richardson et al. 1995).

Most toothed whales hear in a frequency range that extends from 1 to at least 120 kHz, but they are most sensitive in the 18 to 42 kHz range (Szymanski et al. 1999). The hearing range of most toothed whales is above the frequency of large vessels (Richardson et al. 1995), so additional large vessel traffic would be unlikely to affect toothed whales echolocation and communication.

Baleen Whales

Unlike toothed whales, baleen whales have not been shown to use echolocation to detect the size and nature of objects. However, baleen whales use sound as a long-range acoustic communication system to facilitate mating and social interactions. Baleen whales are thought to be most sensitive to a range of low-frequency sounds occurring in the 0.01 to 1 kHz range (Merchant et al. 2012). Most industrial sounds, including those from large vessels, fall within the hearing range of baleen whales. However, most baleen whales show no avoidance of vessels, provided they are not directly approached by them (Watkins 1986).

8 Species that do not receive protection under the ESA.

<u>Pinnipeds</u>

Pinnipeds, like toothed whales, are sensitive to noise above 1 kHz. Most pinnipeds hear at frequencies between 1 and 50 kHz, and some can detect intense higher frequencies up to 60 kHz (Richardson et al. 1995, Schusterman 1981, Schusterman et al. 1972). Pinniped hearing ranges occur above frequencies emitted by large vessels, as evidenced by their generally mild or lack of response to large vessels. Pinnipeds commonly approach vessels, indicating their high tolerance for vessel noise and presence (Richardson et al. 1995).

3.6.2.4 Sea Turtles

Marine turtles with the potential to occur in the vessel corridor include the leatherback, loggerhead, olive ridley, and green sea turtles (Table 3.6-9). All sea turtles are listed under the ESA and are under the joint jurisdiction of NOAA and the USFWS. Critical habitat has been designated for the leatherback sea turtle off the Washington, Oregon, and California coasts (NMFS and NOAA 2012).

Table 3.6-9. Marine Turtles with the Potential to Occur in the Vessel Corridor

Species	Scientific Name	Relative Abundance	Primary Location[a]	Primary Prey	Season(s) Present	Federal/State Status	Occurs in Vessel Corridor?
Leatherback sea turtle	*Dermochelys coriacea*	Common	Ocean	Jellyfish	Summer/ fall	Federally and state-listed as endangered	Yes
Loggerhead sea turtle	*Caretta*	Rare	Ocean	Shellfish/ jellyfish	Uncommon	Federally listed as endangered and state-listed as threatened	No
Olive Ridley sea turtle	*Lepidochelys olivacea*	Rare	Ocean	Fish/shellfish/ jellyfish/algae	Uncommon	Federally listed as threatened	No
Green sea turtle	*Chelonia mydas*	Uncommon	Ocean	Seagrass/ algae	Uncommon	Federally and state-listed as threatened	No

* "Ocean" includes all water westward off the Washington coast.

All four species of sea turtles in Table 3.6-9 are highly migratory. The distribution of sea turtles in the ocean off the US West Coast is strongly affected by seasonal changes in water temperature. The Pacific Coast experiences cool water temperatures (less than 68°F), where sea turtles are far less abundant compared to warmer waters. Cool water temperatures prevent sea turtles from nesting on US West Coast beaches and may also inhibit reproductive activity, by reducing the quality and availability of food resources in the area. The northernmost known nesting sites of leatherbacks and olive ridley sea turtles in the eastern Pacific Ocean occur along the Baja California coast. After nesting, female leatherbacks migrate north and can be found in summer and fall off the Washington coast, particularly off the Columbia River mouth, where they feed on jellyfish (WDFW 2012).

The occurrence of marine turtles in the vessel corridor would be atypical, with the exception of leatherbacks, which could be present in the vessel corridor. The other three species would not be expected to occur in the vessel corridor and are not further discussed in this EIS.

3.6.2.5 Invertebrates

Species of aquatic organisms that exist on or within the bottom sediments within the study areas include the sand shrimp (*Crangon* spp.), daphnia (*Daphnia* spp.), and copepods. Marine invertebrate populations of the intertidal and shallow subtidal habitats represent an abundant and highly diverse assemblage of species including crabs, sea urchins, snails, sea stars, barnacles, sponges, octopi and a wide variety of bivalves. Invertebrates are important prey organisms for the fish species present in the Columbia River estuary (Bottom and Jones 1990). Recolonization of invertebrates varies considerably with geographic location, sediment composition, and types of organisms inhabiting the area (Kennish 1997). Rates of invertebrate community recovery after disturbance range from several months to as much as 2 to 3 years based on substrate type and currents in the affected area (NMFS 2003).

3.6.3 Impact Assessment

3.6.3.1 Proposed Facility

Construction

Construction work within the Columbia River channel would include removal of 11 steel piles and 4 steel fender piles during removal of a single breasting dolphin and installation of up to 40 temporary steel pipe or H-piles to support concrete formwork that may be required at Berth 13. Piles would be removed by vibratory extraction, by pulling them directly with a crane mounted on a barge, or by cutting them off at or below the river bottom. Temporary piles would be installed and removed using a vibratory hammer operated from a derrick barge. During installation, each pile would be lifted by a crane, lowered into place at the mudline, and driven to the required depth.

All pile installation and removal would occur within a work window[9] to minimize impacts to important aquatic species during important life stages. The Applicant proposed an in-water work window of November 1 to February 28 to minimize potential impacts to native fish species, particularly to ESA-listed salmonids and Pacific eulachon (Columbia River smelt) in the proposed Facility study area. As part of the aquatic species impact analysis, EFSEC coordinated with WDFW to find the least impactful in-water work window for construction of the proposed Facility marine terminal modifications. An in-water work window of September 1 through January 15 would be more appropriate to avoid peak migration and larval stages of salmonid and nonsalmonid species (especially eulachon and white sturgeon) in the proposed Facility study area. An increase in the presence of eulachon eggs and larvae is expected to occur from January 16 to February 28, so in-water work that is carried out during this time would have greater impacts to this species. An in-water work window that ended in mid-January would also avoid early spring migration of some salmonid species. The EFSEC modified in-water work window is included as a mitigation in Section 3.6.5.

The USACE is also reviewing proposed modifications to Berths 13 and 14 through an application for US Department of the Army authorization under CWA Section 404 and Rivers and Harbors Act Section 10. The Applicant submitted an application to the USACE on February 12, 2014, describing seismic and safety upgrades, installation of concrete anchors to existing steel piles, minor configuration modifications to existing mooring facilities, and installation of a transfer pipeline on one of the mooring facility piers (Berth 14) (USACE 2015). As of the publication date of this Draft EIS, the permit application is still under review.

Effects from Facility construction on aquatic species could include underwater noise disturbance generated by pile driving (in-water and upland), decreased water quality from suspended sediment mobilized during pile removal and installation, accidental releases of small amounts of hazardous materials, and stormwater runoff from upland areas. During construction activities, mobile species such as fish and marine mammals would be expected to leave the immediate area where demolition and construction activity would be focused. Animals displaced by construction activities may relocate into similar habitats nearby; however, the lack of adequate nearshore habitat in the Project vicinity could result

9 A period of time in which all construction activities that occur below the ordinary high water mark (OHWM) would be completed.

in some species utilizing suboptimal habitat. Effects to aquatic species with the potential to occur in the Project are discussed below.

Aquatic Habitat

Construction associated with the marine terminal has the potential to affect marine vegetation and previously disturbed nearshore habitat. Modifications to the existing marine terminal structure would add 920 square feet of coverage in already degraded habitat. Installation of 40 temporary 18- to 24-inch-diameter support piles would temporarily reduce benthic habitat available for invertebrates. These piles could result in reduced prey for juvenile fish and ESA-listed salmonids and other fish relying on benthic macroinvertebrates during construction. However, the temporary piles would be removed at the end of the construction period, holes left would be filled naturally by ongoing river sediment transport, and would ultimately be recolonized by invertebrates. In addition, the proposed removal of 15 existing piles and the existing overwater coverage would similarly recover. Therefore, habitat effects associated with modification of the existing marine terminal structure would be minor.

The presence of the derrick barge in the nearshore environment during pile installation and removal would cause temporary shading of that habitat. However, the barge would not be present for a long enough duration to result in any long-term, measurable change to habitat in the area.

Ground improvement activities adjacent to the river could bring some soil/grout mixture spoils to the surface. If this mixture were to be introduced to the Columbia River, it could increase localized turbidity and pH levels in the river. The change in water quality could result in localized reductions in prey for juvenile fish and ESA-listed salmonids and other fish relying on benthic macroinvertebrates during construction. The Applicant has proposed BMPs that would contain and direct all spoil materials away from the river. Due to implementation of these BMPs the effect on water quality and macroinvertebrates from ground improvement activities would be minor. If at any time the proposed ground improvement work (stone and jet grout columns) is anticipated to result in the release of sediments below the high water line, work would be limited to an in-water work window.

Ground improvement work could occur at night to ensure work is completed within an in-water work window and would require additional temporary lighting on the shoreline, increasing the amount of light on nearshore aquatic habitat. The increase in lighting would be temporary and unlikely to alter habitat in the area. Furthermore, since much of the area is industrialized and is already subject to night lighting, this effect would be temporary and minor.

Direct effects to deep freshwater (Columbia River channel) and freshwater tidal wetland habitat would not be expected as a result of construction activities due to their location outside of the direct construction area. Suspended sediment, resulting from pile-driving activities, could be washed into these habitat types. However, a recent study associated with the Columbia River test pile program documented that pile installation activities did not result in any significant increases in turbidity above background levels (DEA 2011). Therefore, significant levels of turbidity would not be expected and resuspension of sediments would be limited to a small area around each pile, therefore effects would be negligible.

The vessel berthing area is currently dredged to depth and additional dredging would not be required. Noise impacts from construction are addressed below.

Essential Fish Habitat Impacts

Pacific salmon freshwater EFH occurs in the Project vicinity. Impacts to water quality during Facility construction could impact this EFH. Water quality impacts to this EFH would be similar to those described above for habitat. Significant levels of turbidity would not be expected as a result of pile driving and resuspension of sediments would be limited to a small area around each pile. Activities associated with in-water vibratory pile driving and upland impact and vibratory pile driving would generate underwater noise that could affect fish in the area, as described below. It is expected that pile driving would cause fish to temporally avoid the area, but would not result in direct fish mortality. Given that sedimentation would be limited and noise effects would occur during an in-water work window, at levels that would not result in death, effects to the Pacific salmon EFH would be minimal. Therefore, effects to EFH from construction associated with Facility modifications would be minor.

Aquatic Species

Aquatic species with the potential to occur in the Project vicinity are described above in Section 3.6.2. A summary of species expected to occur during both the Applicant's and EFSEC's in-water work windows are provided in Table 3.6-10. Effect to species that have the potential to occur in the Project vicinity are discussed below.

Table 3.6-10. Species Potential to Occur in the Project Vicinity during the In-Water Work Windows

Species	Presence
Chinook salmon	Juveniles, Adults
Chum salmon	Adults
Coho salmon	Adults
Sockeye salmon	Not present
Steelhead trout	Juveniles, Adults
Bull trout	Adults
Pacific lamprey	Adults, Juveniles
River lamprey	Adults, Juveniles
Eulachon	Eggs, Adults
Green sturgeon	Adults
Pink salmon	Adults possible but rare
Mountain whitefish	Adults
Resident riverine fish (minnow, sucker, sculpin, stickleback)	Present – spend entire lifecycle in Columbia River
Forage fish (e.g., herring, anchovy, smelt, sand lance, etc.)	Not present
Surfperch	Not present
Bay pipefish	Not present
Coastal pelagic species (e.g., mackerel, squid)	Not present
Rockfish	Not present
Shark, skate, chimera	Not present
Flatfish (e.g., sole, flounder)	Starry flounder adults and juveniles possibly present
Marine mammals	Steller sea lions, California sea lions, Pacific harbor seals possibly present
Sea turtles	Not present

<u>Resident and Nonresident Fish</u>

Resident fish may be disturbed by construction activities and would likely temporarily move to adjacent suitable habitat for the duration of the activity. Nonresident fish species use the area near the proposed

Facility as a migratory corridor such as ESA-listed salmonids on their way to spawn. Nonresident fish using the area as a migratory corridor are under physiological directive to reach preferred habitat (spawning or rearing habitat) and would likely move around objects such as vessels and avoid disturbance associated with Facility construction.

Noise

In-Water Vibratory Pile Driving

Underwater noise would be generated during construction by pile driving and work boat/barge movements. Of these sources, pile driving during construction would generate the greatest noise emissions (WSDOT 2014). Under the Proposed Action, the existing 18-inch-diameter steel piles associated with the Berth 13 dock, along with the two associated breasting dolphins and two mooring dolphins, would be improved. The proposed Facility would not require the installation of any additional permanent piles below the OHWM of the Columbia River. However, the installation of up to 40 temporary 18- to 24-inch-diameter, open-ended support steel pipe or H-piles may be required. These temporary support piles would be installed and removed with a vibratory hammer located on a derrick barge. The vibratory hammer method is a common technique used for pile placement and/or in sediments typical of this area and produce less noise than impact hammers. All pile placement and removal would occur within an in-water work window to minimize impacts to important life stages of listed fish species that may occur in the area at other times of the year.

Underwater noise generated from pile driving would be anticipated to propagate through the water until blocked by land masses (e.g., the Columbia River bank) before attenuating to measured background levels. Noise levels estimated as peak, RMS, and SEL values for each of the pile types proposed using a vibratory hammer are provided in Table 3.6-11. Based on a review by the California Department of Transportation (Illingworth and Rodkin 2007), noise levels may range from 175 to 182 dB_{PEAK} and from 160 to 165 dB_{RMS} for a 24-inch pile and 165 dB_{PEAK}, and 150 dB_{RMS} for steel H-piles.

Table 3.6-11. Anticipated Noise Levels Associated with Unattenuated Sound Preserves for In-Water Pile Installation using a Vibratory Driver/Extractor

Pile Diameter (inches)	Water Depth	Average Sound Pressure Measured in dB		
		dBPeak	dBRMS	SEL
18	NA	NA	NA	NA
24	~ 15 meters	175-182	160-165	160-165
Steel H-piles	< 5 meters	165	150	150

Source: Illingworth & Rodkin 2007

dBPeak = peak sound level in decibels, dBRMS = root mean square average sound in decibels; impulse level (35-milisecond average), NA = data not available, SEL = sound exposure level for 1 second of continuous driving

Adult fish are able to detect noise over a large range of frequencies, from 10 to several hundred Hertz (Hz), when the noise level is greater than approximately 30 decibels above their hearing threshold (Mitson 1995). WSDOT (2014) identified the behavioral threshold of fish from vibratory pile driving at 150 dB_{RMS} and an injury threshold range of 183 to 206 $dB_{RMS,}$ depending on fish size (Table 3.6-12). Anticipated Project noise levels associated with vibratory driving would range from 150 dB_{RMS} (steel h-piles) to 165 dB_{RMS} (24-inch piles), which is below the fish injury threshold for all pile types and fish species, but is at or slightly above the behavioral threshold identified for fish. Therefore, vibratory pile-driving activities would not be expected to result in direct mortality of fish but may cause fish to temporarily leave the area during construction activities. The nearest similar low slope beach habitat to that found in the Project vicinity is 1.25 miles downstream.

Table 3.6-12. Fish Disturbance and Injury Thresholds for Vibratory Pile Driving

Functional Hearing Group	Underwater Noise Thresholds for Vibratory Pile Driving	
	Disturbance Threshold	Injury Threshold
Fish ≥ 2 grams	Behavior effects threshold 150 dB RMS	187 dB Cumulative SEL
Fish < 2 grams		183 dB Cumulative SEL
Fish all sizes		Peak 206 dB

Source: WSDOT 2014

dB RMS = Root mean square average sound in decibels; impulse level (35-milisecond average),
SEL = sound exposure level for 1 second of continuous driving

For younger life-history stages, a study on the behavior of larval fish (including salmonids and minnows) in response to exposure to varying levels of sound found no significant effect on behavior or on fish tissue (auditory and nonauditory; Jorgensen et al. 2005, as cited in Popper and Hastings 2009). Although less information is available on effects to ESA-listed eulachon eggs and larvae, the presence of eulachon eggs and larvae would generally occur after the in-water work windows, thereby minimizing potential effects of construction noise to early life-history-stage eulachon.

Vibratory pile driving associated with insertion and removal of the 40 temporary support piles would lead to a temporary increase in underwater noise levels in the proposed Project vicinity, which could cause behavioral avoidance but is unlikely to cause injury. All in-water pile driving would occur during an in-water work window to minimize impacts to juvenile ESA-listed salmonids and peak run timing of adult salmonids and eulachon spawning and migration. Overall, noise impacts to aquatic species would be temporary and fish would likely recolonize vacated habitat upon completion of pile-driving activities; therefore, effects to fish from underwater noise generated from pile driving would be moderate.

Upland Pile Driving

Sound flanking is the transmission of sound waves through substrate and into the aquatic environment and may occur from upland impact and vibratory pile-driving activities. Sound flanking has been documented in the literature to generate elevated underwater sound pressure levels in adjacent aquatic habitats (California Department of Transportation 2012). Site conditions can vary the extent to which sound pressure is transmitted to the adjacent aquatic environment. WSDOT (2014) has not identified airborne noise thresholds for fish; however, fish that are foraging or using the area for cover during upland impact and vibratory pile-driving activities could leave the area. All upland pile driving would occur during an in-water work window to minimize impacts to ESA-listed juvenile salmonids and peak run timing of adult salmonids and eulachon spawning and migration. Impacts would likely be less during the EFSEC in-water window as opposed to the Applicant suggested in-water work window. Although sound flanking noise levels from upland pile-driving activities cannot be calculated, overall, noise impacts to aquatic species from upland pile driving would be reduced through use of a work window, remaining impacts would be temporary, and fish would likely leave the area during construction and return to the area upon completion of pile-driving activities. Therefore, effects to fish from upland pile driving would be moderate.

Water Quality

Impacts to water quality during proposed Facility construction, including pile driving, could directly impact fish and the Pacific Coast salmon freshwater EFH within the Project vicinity. Water quality impacts include temporary turbidity from sediment disturbance during pile and decking removal and pile installation; increases in pH from ground improvement measures; leaching of existing subsurface soil contaminants into the surface water during sediment disturbance activities (i.e., pile removal and installation); and inadvertent releases of fuels and lubricants into the waterway. The zone of impact associated with temporarily increased levels of sedimentation and turbidity due to construction activities is defined as 300 feet downstream of proposed Project activities. This area conforms with and was defined based on the Ecology-authorized turbidity mixing zone for waters above 100 cubic feet per second at a time of construction (WAC 173.201A-030).

Pile installation and removal may temporarily cause elevated levels of disturbed sediment and turbidity in the water, which could stress fish in the area. Increased turbidity could interfere with gill function or limit fish vision, which could increase predation. However, increased turbidity associated with pile installation and removal is expected to be minor, localized, temporary, and unlikely to result in physiological stress to fish in the area. Further, a recent study associated with the Columbia River test pile program documented that pile installation activities did not result in any significant increases in turbidity above background levels (DEA 2011). Therefore, significant levels of turbidity would not be expected and temporary resuspension of sediments would be limited to a small area around each pile. Effects to fish from the small increase in turbidity would likely be limited and localized.

Chemical contaminants could be released directly into the Columbia River during construction activities or indirectly through stormwater runoff from land-based operations. Chemical contamination could include resuspension of existing contaminated soils, changes to pH in the event that ground improvement slurries (jet grout) are spilled during construction, or contamination of the waterway from petroleum products or lubricants leaked from fueling construction vehicles and equipment. Petroleum products or lubricants leaked from fueling construction vehicles and equipment could expose fish to hydrocarbons causing physiological stress and reduced fecundity. However, various BMPs would be in place to reduce the potential for leaks and spills. BMPs include locating temporary material and equipment staging areas above the waterbody's OHWM and outside environmentally sensitive areas, including wetlands and established wetland buffers. An EFSEC-approved SPCC Plan would define specific BMPs to minimize the potential for leaks and spills, as well as minimize the extent of damage from any unavoidable leaks or spills from construction equipment.

Sediment contamination for PAHs, PCBs, and PBDEs exists in the Lower Columbia River, although the precise locations of all of these contaminants is not known. PAHs, PCBs, and PBDEs were found throughout the Lower Columbia River in water, sediment, and juvenile Chinook salmon (Lower Columbia River Estuary Partnership 2015). The installation of 40 temporary support piles could result in resuspension of contaminated sediments in the event that contamination occurs in the construction area. However, it is not known if the construction area contains such contaminants.

Proposed ground improvement activities adjacent to the abutment for Berth 13 improvements involves in-situ injection and mechanical mixing of cementitious grout (jet grout) into the soil for stabilization, which can significantly raise the pH and turbidity of water contacted. Similarly, vibroreplacement (stone column) construction could cause the release of water with high total suspended solids into nearby waterbodies, including stormwater systems, the Columbia River, and nearby wetlands. A substantial increase in pH can alter the aquatic environment, reducing available nutrients, resulting in reduced fecundity and mortality of fish species present.

To address these concerns the Applicant proposes to install temporary sheet pile wall protection between the jet grout installation areas approximately 1 to 2 feet landward of the OHWM to a depth of approximately 40 feet bgs to act as a barrier to grout migration waterward of the OHWM. Additional protective measures include isolation measures to contain spoils, extraction and disposal of spoils, capture and treatment of high pH water, and monitoring. The Applicant has proposed daily monitoring for turbidity and weekly monitoring for pH during concrete pouring and curing; monitoring for turbidity, sediment, and pH in stormwater discharges from the site during construction; and adherence to an EFSEC-approved SWPPP.

These measures in combination with the Applicant's proposed BMPs are intended to prevent contamination of surface waters from construction activities. However, because the effectiveness of these measures to protect water quality and fish during construction are uncertain, impacts are expected to be minor to moderate. Impacts to water quality from small spills and leaks of hazardous materials are expected to be minor if an EFSEC-approved SWPPP and Applicant-proposed BMPs to prevent contamination of surface waters are adhered to during construction activities.

Lighting

Ground improvement work at the marine terminal may occur at night to ensure work is completed within an in-water work window. Night work would require additional temporary lighting on the shoreline, increasing the amount of light on nearshore aquatic habitat. Most fish use vision to orient and perform activities such as foraging, breeding, and avoiding predators. Fish behavior can be affected by artificial light stimuli. A common reaction of fish groups in the presence of artificial light is to school and move toward the light source. This behavior to aggregate and be drawn to light varies by species (Marchesan et al. 2004). The presence of artificial lighting during construction can also facilitate nocturnal predation by visual aquatic predators and fish-eating birds. It is anticipated that lighting would cause some behavioral changes to fish in close proximity to the lighted areas, but since much of the area is industrialized and is already subject to night lighting, this effect would be temporary and minor.

Marine Mammals

ESA-listed Steller sea lions and Pacific Harbor seals and unlisted California sea lions that are present in the Columbia River may be disturbed by construction activities and would likely be temporally displaced due to increased noise levels associated with pile driving, but would be expected to return to the area upon completion of work.

Noise

In-Water Vibratory Pile Driving

Pinnipeds (sea lions and seals) in the Project vicinity could be disturbed by noise associated with vibratory pile driving. The noise may cause them to cease feeding in the vicinity until work is completed. Noise levels from in-water vibratory pile driving estimated as peak, RMS, and SEL values for each of the pile types proposed using a vibratory hammer are provided in Table 3.6-13. Pinnipeds have sensitive hearing across a fairly wide band of frequency, ranging from approximately 0.05 to 50 kHz, and underwater peak sensitivity occurring in the 1 to 25 kHz range (Kastelein et al. 2005, Okeanos 2008). WSDOT (2014) identified the behavioral threshold of pinnipeds from vibratory pile driving as 120 dB_{RMS} and set an injury threshold at 190 dB_{RMS}. Noise associated with vibratory pile driving would be above the disturbance threshold for all pile types, but below the injury threshold.

Table 3.6-13. Injury and Disturbance Thresholds for Construction Activity

Functional Hearing Group	Underwater Noise Thresholds for Vibratory Pile Driving	
	Disturbance Threshold	Injury Threshold
Pinnipeds (sea lions and seals)	120 dB_{RMS}	190 dB_{RMS}

Source: WSDOT 2014

dB_{RMS} = decibel root mean square (average sound level).

Under WSDOT's (2014) definition of Level B Harassment (biologically significant disturbance) for nonpulse noise, noise attenuation could occur over a distance of 137 miles in an open environment; however, the actual zone of impact would be approximately 6 miles given the geographic constrictions of the Columbia River (Figure 3.6-1; Vancouver Energy 2015). Pinnipeds may be present in this area, particularly during the spring months, when they follow prey upriver during their spring migration (Scordino 2010). Both in-water work windows would avoid impacts during periods when pinnipeds may be more abundant and no pile-driving activities would occur during the pinnipeds' spring migration. Pinniped abundance in the Project vicinity during the in-water work windows are expected to be less than during spring months due to reduced availability of prey species during that period (Scordino 2010), but some individuals may still be present.

To minimize noise impacts to marine mammals the Applicant would prepare and implement a marine mammal monitoring plan (MMMP; Appendix D.10). According to the MMMP, two qualified observers would be stationed approximately 1.75 miles from either end of a 6-mile monitoring zone (Figure 3.6-1). These observers would conduct monitoring prior to and during in-water pile installation and removal activities. Should a pinniped be detected within the monitoring area, construction activities would be stopped and would not restart until after the marine mammal has left the monitoring area (Vancouver Energy 2015). Should unobserved pinnipeds occur in the Project vicinity during construction activities, noise levels would exceed pinnipeds disturbance threshold and they would likely move away from the area. Overall, noise impacts to pinnipeds from pile-driving activities would be temporary and they would likely return to the area upon completion of in-water pile-driving activities. Because pile-driving activities would occur outside of the timeframe of pinniped abundance in the Columbia River, impacts marine mammal are expected to be minor to moderate.

Upland Pile Driving

Sound disturbance would likely be the primary impact of upland construction activity on pinnipeds. For upland pile driving (impact and vibratory), sound flanking could generate elevated underwater sound pressure levels in adjacent aquatic habitats (California Department of Transportation 2012). WSDOT (2014) identified the airborne noise threshold for pinnipeds at 90 to 100 dB_{RMS} (Table 3.6-14). Terrestrial noise generated during impact installation of upland piles would be approximately 110 dBA, measured at 50 feet (Vancouver Energy 2015). This level exceeds pinnipeds noise thresholds of 90 to 100 dB. Noise associated with vibratory pile driving is less than impact driving as the impact noise of the pile-driving hammer is eliminated. Vibratory pile driving produces a continuous sound with peak pressures lower than those observed in pulses generated by impact pile driving. Noise emission levels for vibratory sheet piling is 96 dBA at 50 feet (DEA 2011). This level exceeds the harbor seals noise thresholds of 90 dB but does not exceed the threshold for sea lions.

Table 3.6-14. Injury and Disturbance Thresholds for Construction Activity

Functional Hearing Group	Airborne Noise Thresholds In Air Sound Pressure Level (RMS)
Harbor seals	90 dB_{RMS}[a]
Sea lions and other pinnipeds	100 dB_{RMS}

Source: WSDOT 2014

a 90 dB_{RMS} for harbor seals, 100 dB_{RMS} for sea lions and all other pinnipeds

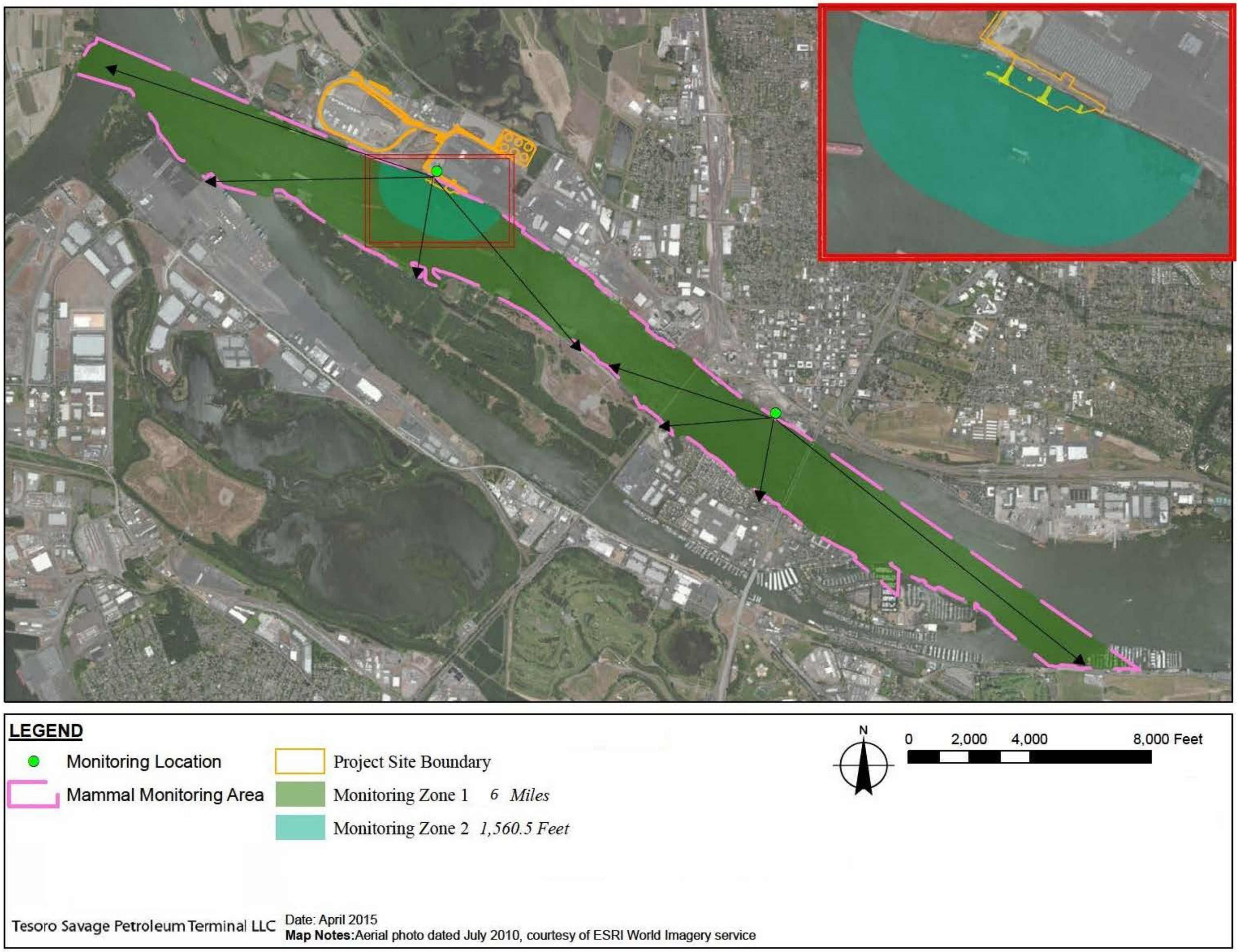

Figure 3.6-1. Marine Mammal Monitoring Area

Upland pile driving could transmit underwater noise to an area approximately 0.3 mile around the proposed Facility (Figure 3.6-1 Zone 2) that may exceed the Level B harassment for impulsive noise for pinnipeds. No pinniped haulout sites or suitable haulout habitat exist within 800 feet of the construction area. Any marine mammals in the area would be in an aquatic environment and subject to underwater noise before reaching the zone of terrestrial noise impacts (Vancouver Energy 2015). Therefore, it would be expected that marine mammals would react to the underwater noise (described above) and leave the area prior to entering the 0.3-mile area around the proposed Facility where upland pile driving could transmit noise.

However, in the event that a marine mammal is present in this area during upland pile driving, the noise generated in the 0.3-mile zone around the proposed Facility would likely cause these animals to cease feeding in the area until work is complete. To prevent harassment, any pile driving would be shut down immediately if a marine mammal is observed entering the monitoring zone, reducing marine mammal harassment.

Should pinnipeds occur in the Project vicinity during construction activities, noise levels would exceed pinnipeds' disturbance threshold and they would likely move away from the area. However, should pinnipeds or other marine mammals be detected the vicinity during pile driving, construction activities would cease until the animals leave the area (which could take from hours to days). Noise effects would be temporary and they would likely return to the area upon completion of upland pile-driving activities. Overall, noise impacts to pinnipeds are expected to be minor to moderate as construction activities would occur outside of the timeframe of marine mammal abundance in the Columbia River.

Water Quality

Water quality effects to marine mammals from construction activities would be similar to those described for fish. Increased turbidity would be small and localized and chemical contamination would be minimized by following BMPs and the SPCC Plan. Impacts to water quality from increased turbidity and hazardous material contamination are expected to be minor to moderate.

Invertebrates

Pile installation and removal may cause elevated levels of disturbed sediment and turbidity in the water, which could bury some sessile aquatic invertebrates, an important food source for many species of fish, including listed fish species. However, these disturbances are expected to be minor, localized, and temporary. Further, a recent study associated with the Columbia River test pile program documented that pile installation activities did not result in any significant increases in turbidity above background levels (DEA 2011). Therefore, high levels of turbidity would not be expected and resuspension of sediments would be limited to a small area around each pile. Further, the flowing nature of the Columbia River would quickly carry any suspended sediment downstream and spread out distribution. Effects to invertebrates from the small increase in turbidity would be minor as these effects would be limited and localized.

Sediment contamination for PAHs, PCBs, and PBDEs exists in the Lower Columbia River, although the precise locations of all of these contaminants is not known. The installation of 40 temporary support piles could result in resuspension of contaminated sediments in the event that contamination occurs in the construction area. Exposure of aquatic invertebrates to resuspension of contaminated sediments, depending on toxicity levels, could be result in sublethal (e.g., physiological stress or reduce fecundity) or lethal (death) endpoints. However, it is not known if the construction area contains such contaminants. If such contaminants do occur in the construction area, the sediment plume, and subsequent effects to aquatic invertebrates would be minor as it would be localized to a small area around each pile and unlikely to affect the overall health of the invertebrate community in the area.

Operations and Maintenance

Aquatic Habitat

Overwater Structure

Modification to the marine terminal would include an additional 920 square feet of overwater structure over already disturbed habitat. Modified structures would increase shading of nearshore habitat and could result in the loss of some vegetation communities. Shade cast from docks can result in different vegetation communities in underdock areas compared to adjacent nonshaded areas (Nightingale and Simenstad 2001). The expansion of the overwater structure at the marine terminal could alter nearshore communities by limiting plant growth. However, the structure modifications proposed by the Applicant could include mitigation measures identified by EFSEC to minimize the impact of shading on nearshore vegetation, including the use of steel grating that is designed to let 60 percent of sunlight penetrate into areas over shallow-water habitat and use of retractable. Impacts to shallow-water habitat would be further minimized by locating truss replacement over deepwater (deeper than -20 feet CRD). Similarly, the retractable walkways would be in place over shallow water (less than -10 feet CRD) when vessels are moored, which would be between 15 and 24 hours per day. Since shading occurs with the existing structures at the marine terminal and modifications to the terminal would result in only 920 square feet of additional shading in an already disturbed area, it is expected that the long-term effects to nearshore habitat associated with the modifications at the marine terminal would be minor.

Lighting

Night lighting used for Facility operations and security could penetrate into adjacent aquatic habitats. Effects from artificial lighting would not likely alter the habitat structure, but may cause increased plant growth or affect habitat utilization by fish and other aquatic species. Effects to fish species from artificial lighting are described in below under Fish Impacts - Lighting.

Vessel Presence

The presence of docked vessels would cause shading of adjacent habitat. The most common vessel calling at the proposed Facility would be the Handymax medium-sized tanker. These vessels are approximately 600 feet long and 105 feet wide. Because Berths 13 and 14 have been in use since the early 1990s, habitat in the vicinity of docked vessels has been exposed to vessel shading during the past 25 years. Therefore, vegetation communities in this area have developed an ability to persist under these conditions. Continued vessel operations at Berths 13 and 14 would have only a minor impact to existing aquatic habitat in the area.

Vessel Wake

Vessel wakes have the potential to impact riparian and wetland vegetation communities directly (i.e., breakage, uproot) or indirectly through altered sediment patterns and erosion. Damage to existing vegetation could impact juvenile fish that utilize this habitat for foraging, cover, and resting. Vessel wakes in the Project vicinity are not expected to be substantial, however, since the vessels would be moving at slow speeds as they are positioned and docked by assist tugs. In addition, Berths 13 and 14 have been in use since the 1990s; therefore, habitat surrounding this area has been altered over the past 25 years to survive a regime of vessel traffic and associated wake. Habitat in the Project vicinity would not experience any notable adverse effects from vessel wake and, therefore, impacts would be minor.

Essential Fish Habitat

Pacific salmon freshwater EFH occurs in the Project vicinity. Impacts to this EFH would be the same as those described above for habitat.

Aquatic Species

Resident and Nonresident Fish

The Project vicinity provides habitat for many resident riverine fish, adult and juvenile forms of several special-status populations of salmon, steelhead, and bull trout, Pacific eulachon, and green sturgeon. While run timing differs by species, populations of these species may be present within the Project vicinity at various times during the year. Because operational impacts would not be restricted to an in-water work window, Facility operation could affect each species and its habitat.

Overwater Structure

Modification to Berths 13 and 14 would add an additional 920 square feet of overwater structure to the existing marine terminal. The presence of an overwater structure and associated shading could disrupt or delay fish access to nearshore habitat. Moving below overwater structures could be disruptive to schooling fish, although fish have been found to readily swim alongside and around overwater structures (Simenstad et al. 1999). The modified structures at Berths 13 and 14 and their associated shading effects would not create a total impediment to movement up or down the river, but may cause a delay in passage as fish swim around the structure instead of using a more direct pathway under it.

To reduce shading, mitigation in the form of structure modifications include the use of steel grating designed to let at least 60 percent of sunlight penetrate into areas over shallow-water habitat and retractable shore-based walkways that would be in place only during periods when vessels are moored. These modifications would minimize the impact of shading and may alleviate fish passage disruptions, making it more likely that fish could pass under the modified overwater structure. Due to the limited area of increased overwater shading and proposed design modifications to reduce overwater shading, minimal disruption of fish access to and through nearshore habitat would be expected. Therefore, the long-term impacts from overwater shading on fish would be minor.

Lighting

Most fish use vision to orient and perform activities such as foraging, breeding, and avoiding predators. Fish behavior can be affected by artificial light stimuli. A common reaction of fish groups in the presence of artificial light is to school and move toward the light source. Levels of aggregation and attraction to light vary by species (Marchesan et al. 2004). The presence of artificial lighting at the dock (including extra spot lighting at the marine terminal loading area) may also facilitate nocturnal predation by visual aquatic predators and fish-eating birds. Lights at the proposed Facility would likely be on during nighttime hours, 365 days a year, to facilitate continuous loading and unloading. This additional lighting could also cause an increase in aquatic plant growth, which could alter habitat use by fish. It is anticipated that lighting would cause some behavioral changes to fish in close proximity to the lighted areas, but since much of the area is industrialized and is already subject to night lighting, this impact would be minor.

Vessel Presence

The approximately 600-foot length and 105-foot width of a Handymax vessel has a draft of approximately 20 feet when in ballast. The largest vessel that could call at the Facility would be approximately 900 feet long and 156 feet wide with a draft when in ballast of 28 feet. The loaded draft of a Handymax vessel would be 41 feet while for all other deep-draft vessels calling at the Facility would be 43 feet. Channel depths at Berths 13 and 14 would be maintained at 43 feet below MLLW. When a vessel is docked, it essentially would be an extension of the dock and fish would be unlikely to swim under a docked vessel (regardless of the draft). The presence of docked vessels for 15 to 24 hours per day during loading operations would constitute a semi-permanent barrier to fish passage and fish use of nearshore habitat directly beneath the vessel. Because Berths 13 and 14 have been in use since the early 1990s, and fish have had access to and passed through the nearshore area during the past 25 years, continued vessel operations at Berths 13 and 14 would be expected to have only a minor impact to fish.

Terminal Noise

Operational noise would likely be generated during transfer of crude oil from the transfer pipeline system to vessels during loading, which would take from between 15 and 24 hours depending on flow rate and other factors. Noise levels associated with this transfer have not been quantified but are anticipated to be lower than for vessel docking.

Water Quality

Impacts to water quality during Facility operation and maintenance activities could directly impact fish within the Project vicinity. Impacts could include the inadvertent releases of fuels and lubricants into the waterway, the introduction of nonnative and exotic species from ballast water, and a change salinity associated with ballast water exchange.

Hazardous Materials

Minor pollutant discharges may occur from small spills and leaks of petroleum products, lubricants, and other chemicals in upland areas or near surface waters during normal operation and maintenance activities. Leaks and drips can subsequently reach surface water directly or through stormwater runoff. In the event that a small amount of hazardous material entered the Columbia River, a small number of individual fish could be adversely affected. However, such incidents would not be expected to occur in a large enough magnitude or with enough frequency to adversely affect fish populations. Therefore, impacts to aquatic species from small spills and leaks of petroleum products and lubricants would be minor.

Ballast Water

Tankers arriving at the proposed Facility to load crude oil would likely be in ballast, having previously flooded their ballast water tanks to maintain the ship's stability. The vessel ballast tanks would contain clean seawater that has either been treated through an onboard ballast water treatment system or collected during a mid-ocean ballast exchange. This practice greatly reduces the risk of transferring aquatic invasive species (AISs) from one location to another and makes it unlikely that aquatic nuisance species would be introduced through ballast discharge.

The ballast pumping rate of vessels anticipated to call at the Facility would range from 6,000 to 15,000 cubic meters per hour (David 2015). At full capacity, the total ballast water anticipated to be exchanged at the Facility is approximately 6 million cubic meters annually.

Vessels at the terminal would discharge ballast into a flowing tidal river environment where the rate of dilution and area of impact would depend upon rate of ballast water release, as well as tides, river discharge, and localized currents. Ballast water, which would be seawater, is denser than freshwater and so would sink upon release into the river and would move downstream and dilute rapidly. It is expected that the salinity in the Project vicinity after completed ballast discharge would decrease back to baseline relatively quickly. Effects, if any, would primarily be to the benthic environment and are discussed below for invertebrates. The potential for salinity changes during discharge of ballast water to affect fish in the area would be minor.

Marine Mammals

Effects to marine mammals from Facility operation and maintenance would be similar to those described above for fish, with the exception of avoidance of overwater structures. The expansion of the existing overwater structure would be unlikely to affect pinnipeds since they are present this far upstream for only a portion of the year (spring) and would be unlikely to be feeding so close to shore. However, pinnipeds could be present in the Project vicinity when ships are arriving at or departing from the proposed Facility. Effects related to vessel traffic are described below in Section 3.6.3.3.

Invertebrates

Water Quality

Ballast Water

The impact of daily exposure to increased salinity, described above for fish, would primarily occur in the benthic environment immediately around the marine terminal and adjacent areas downstream, with impacts gradually decreasing with distance downstream of the marine terminal berths. Benthic communities exposed to daily increases in salinity could decrease in species abundance and biomass or change in species composition. Some areas of the Columbia River estuary downstream of the proposed Facility site within the estuarine mixing zone contain benthic communities adapted to frequent changes in salinity. These benthic communities tend to have lower standing crops of invertebrates than other communities in the Columbia River estuary and tend to be dominated by species that are tolerant of a range of salinities (Jones et al. 1990). The benthic areas impacted by daily increases in salinity due to ballast water release would likely experience a decline in less saline-tolerant species, a possible increase in saline-tolerant species, and an overall decline in species diversity and biomass. While these effects would occur over the Project life, they would be localized and likely represent only a minor impact.

Propeller Scour

The movement of water from vessel propellers and resulting movement of sediment from the river bottom is termed “propeller scour.” Propeller scour from vessels and escort tugs could result in impacts to benthic communities (Haas et al. 2002) through disturbance of sediments on the river bottom. Benthic invertebrates contained within sediments that are subject to scour could be directly removed and destroyed or settle elsewhere, and sedentary benthic organisms close to the propeller scour areas could be buried by sediments. Propeller scour and associated impacts to benthic communities would repeatedly occur in locations where vessels are positioned and docked by tugs at Berths 13 and 14. More mobile invertebrates are likely to move to other areas not subject to repeated disruptions. Hydraulic scouring caused by vessel and tugboat maneuvering activities may impact both the deeper water areas in berth and vicinity and in adjacent shallow nearshore habitats (Haas et al. 2002), causing a localized minor but long term change in the benthic community.

Decommissioning

Facility decommissioning would involve the removal of some facilities associated with the proposed Facility, although at the present time, Berths 13 and 14 are anticipated to be left in place. Decommissioning activities associated with the marine terminal (Area 400) are limited to crude oil loading equipment, spill prevention, response, and containment equipment, and some associated upland structures (Table 2-9). Decommissioning of upland portions of the proposed Facility would have similar impacts as described for Facility construction, including disturbances from equipment operation, inadvertent releases of fuels and lubricants from construction equipment, and temporary noise impacts.

3.6.3.2 Rail Transportation

The rail corridor study area within Washington crosses over and is adjacent to more than 500 streams and waterbodies between the Washington-Idaho border and the proposed Facility site in Vancouver (Appendix P.3). The rail route crosses many freshwater rivers and smaller tributaries to the Columbia River and Pacific Ocean, including approximately 75 fish-bearing streams and 44 shoreline streams. East of the Cascades, freshwater lakes and tributaries within the rail corridor could provide potentially suitable habitat for inland special-status fish species, amphibians, reptiles, and invertebrates. Impacts to aquatic habitats and species in Washington, Idaho, Montana, and North Dakota could occur in the event that waterbodies are impacted by hazardous materials that enter waterways. Increased rail operations could contribute to the accumulation and transportation of caked-on grease on tracks and creosote discharge from old railroad ties. However, it is unlikely that the volumes of these materials would disperse outside of the immediate rail tracks and unlikely that they would enter waterways in sufficient quantities to cause adverse impacts to surface water and associated impacts to fish, amphibians, reptiles, and invertebrates. Overall, impacts to aquatic species from normal rail operations would be negligible and not be expected to increase as a result of Facility operations.

3.6.3.3 Vessel Transportation

Aquatic Habitat

Effects to habitat types present in the vessel corridor would primarily result from vessel wake or from leaks of fuels or lubricants from transiting vessels. Localized reductions of existing vegetation, prey, and overall juvenile fish habitat function could occur from wakes during vessel transit. Vessel wakes have the potential to impact riparian and wetland vegetation communities directly (i.e., breakage, uproot) or indirectly through altered sediment patterns and erosion. Damage to existing vegetation could impact juvenile fish that utilize this habitat for foraging and resting. Effects from vessel wake are more common in the presences of deep-draft vessels.

The increase in deep-draft vessel transits[10] associated with the proposed Facility (365 per year) would represent an approximately 223 percent increase from the 164 deep-draft transits recorded by Ecology in 2013 (Ecology 2014). While this percentage increase is substantial, the potential for negative affects to habitats would be limited to the lower river (approximately 33 miles) of the Columbia River where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less 10 percent. Wake effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The habitat types in these areas serve as important nursery grounds for juvenile fish. The increase in deep-draft vessel traffic and associated increase in vessel wakes could reduce the vegetation communities in these areas, resulting in a moderate to major long-term change to the resource, indirectly affecting fish species that rely on these habitats to complete their life cycle.

Water quality effects to aquatic habitat could result from leaks of fuels or lubricants from vessels transiting to and from the proposed Facility. Small spills of such materials would have a minor impact to aquatic habitat present in the vessel corridor since the small quantity of spilled material would quickly dilute in the volume of water within the river and ocean.

Essential Fish Habitat

Pacific salmon, groundfish, and pelagic species EFHs occur within the vessel corridor from the Columbia River mouth to 3 miles at sea, at the start of the EEZ. Impacts to EFH within the vessel corridor associated with increased vessel traffic could be noise from vessels, leaks of fuels or lubricants from transiting vessels, or wake-induced habitat changes from an increase in deep-draft vessels using the Columbia River.

Vessel traffic associated with Facility operation could adversely affect EFHs by temporarily increasing noise levels near transiting vessels and fish would likely move away from the source of noise (Mitson 1995). Fish are able to detect vessel noise over a large range of frequencies, tens to several hundred Hz (Mitson 1995). Avoidance reactions in fish occur at a distance of approximately 100 to 200 meters (328 to

10 Ecology (2014) counts only entering transits for vessels; thus, a “transit” can be considered to be one entry and one exit per vessel.

656 feet) from the vessel, but could occur at distances up to 400 meters (1,312 feet) in louder vessels (Mitson 1995). Vessels currently travel up and down the Columbia River and noise impacts to EFH is currently ongoing. Noise from vessels is of short duration as the vessels pass through EFH. The added noise from the increase in vessel transits associated with the proposed Facility would result in a minor localized impact to Pacific salmon, groundfish, and pelagic species EFHs.

Localized reductions of existing vegetation, prey, and overall EFH function could occur from wakes during vessel transit. Wake effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. Pacific salmon, groundfish, and pelagic species EFHs occur within this area. As described above for habitat, the increase in deep-draft vessel traffic and associated increase in vessel wakes could result in a moderate to major long-term change to theses EFHs.

Water quality effects to EFH could result from leaks of fuels or lubricants from transiting vessels. However, impacts to EFH present in the vessel corridor would be minor because the small quantity of spilled material would quickly dilute in the volume of water within the river.

Aquatic Species

Fish

Underwater Noise

Underwater noise would be generated by vessels as they transit through the Columbia River. Vessel movement to and from the proposed Facility would occur within existing designated shipping lanes, which are characterized as having high levels of use by both commercial and recreational vessels. Noise associated with vessels calling at the proposed Facility would likely cause low-frequency transitory peaks to background noise levels, so they would not likely contribute a significant increase in ambient noise within the vessel corridor study area.

Adult fish are able to detect vessel noise over a large range of frequencies, from 10 to several hundred Hz, when the noise level is greater than approximately 30 decibels above their hearing threshold (Mitson 1995). Fish within a few hundred meters of passing vessels may exhibit avoidance behaviors (Mitson 1995). The increase of one vessels transit a day would add two exposure incidents to vessel noise per day (one inbound and one outbound trip) for fish that are within the potential disturbance range of the vessels (341 meters, assuming a vessel sound source level of 188 dB_{RMS} re 1 microPascal at 3.3 feet [1 meter]) and disturbance threshold of 150 dB_{RMS} [WSDOT 2014]). Given the high mobility of most fish,[11] including migratory salmon, individuals present in the area at the time of a transiting vessel would be expected to be disturbed and would likely move away from the source of noise. Vessels currently travel up and down the Columbia River and noise impacts to resident and migratory fish are currently ongoing. Noise from vessels is of short duration as the vessels travel through the Columbia River. Although additional vessel transits would result in transitory peaks in vessel noise, they would not likely contribute to a substantial increase in ambient noise within the vessel corridor study area; therefore, impacts would be minor and transitory as vessels move through the vessel corridor study area.

Entrainment

Entrainment is the direct uptake of aquatic organisms by the suction field generated by water intakes on vessels. Sources of entrainment include vessel engine cooling water, ballast water, and terminal utility water intakes. Impacts from entrainment could include physical stress due to pressure changes or abrasions or mortality from contact with screens and pump impellers. The change in pressure associated

11 Some species and life stages are less mobile.

with water intakes can burst the swim bladders of some species. The potential for entrainment would primarily affect fish eggs and larval fish because larger adult fish have been found to escape entrainment by avoiding large vessels (Dettmers et al. 1998). Because entrainment is associated with specific life stages, the effects would be limited to times when eggs and larval fish are present in the vessel corridor study area. Vessels currently travel up and down the Columbia River and entrainment impacts to eggs and larval fish are currently ongoing. While the proposed Facility would increase the number of vessels using the Columbia River navigation channel from the baseline of 1,457 vessel transits in 2013 to approximately 1,822 vessel transits, this amount would be below the peak historical number of 2,269 vessel transits. While the increase in the number of vessel trips per day is not large compared to the baseline condition, the additional vessel trips would increase the potential for entrainment and could result in a minor additional impact to the reproduction, population size, or distribution of fish species present in the vessel corridor.

Wake Stranding

Wake stranding occurs when aquatic species are lifted by a wave onto a shoreline and become stranded. The incidence of wake stranding observed for deep-draft vessel traffic along the Lower Columbia River below Vancouver is an issue of ongoing active management concern (Nair et al. 2012). Recent monitoring studies on wake stranding have focused on deep-draft vessels because smaller vessels and barges typically do not cause stranding (Pearson and Skalinski 2011). A recent study of observations limited to deep-draft vessels (e.g., bulk carriers, oil tankers, car carriers and container ships) reported that oil tankers produced the greatest stranding effects (Pearson and Skalinski 2011).

While past studies on wake stranding on the Lower Columbia River (Pearson et al. 2011, Pearson et al. 2006) have concluded that the specific mechanisms of stranding are still not completely understood, existing research indicates that the potential for wake stranding appears to be related to the characteristics of the vessel (vessel geometry and speed) and of the site (shoreline features, tidal height, total wave excursion, and nearshore salmon densities) (Bauersfeld 1977, Hinton and Emmett 1994, Ackerman 2002, Pearson et al. 2006). Pearson et al. (2006) prepared a spatial analysis based upon existing reports in the Lower Columbia River and determined that physically based susceptibility to stranding of juvenile salmonids (and by extension other fish present in the vessel corridor) by vessel wakes occurs primarily along a 33-mile portion of the lower river where shorelines and beaches have slopes less than 10 percent and are not shielded from wave action.

Given that wake stranding is more common in the presence of deep-draft vessels, the approximately 223 percent increase in deep-draft vessel traffic associated with the proposed Facility could result in a moderate to major long-term effect on nearshore fish including listed salmonids and eulachon species in the lower 33-mile portion (16 percent) of the Columbia River.

Water Quality

Water quality effects to fish could result from leaks of fuels or lubricants from transiting vessels as well as increased turbidity due to vessel turbulence. The small quantity of leaks that could occur would have a minor impact to aquatic species present in the vessel corridor since the small quantity of spilled material would quickly dilute in the volume of water within the river and ocean. Vessel-caused turbulence can contribute to turbidity, which deprives submerged plants and sight-feeding species of necessary light. However, this source of turbidity is small compared to nutrient enrichment and sediment runoff resulting from human-caused changes in watersheds (USACE 2012). Miller and Payne (1996) found that changes in turbidity from vessel turbulence were minor and of short duration. Given that vessels would be using the existing vessel traffic lane, effects to aquatic species from turbidity associated with Project-related vessel traffic would be minor.

Marine Mammals

Underwater Noise

Increased traffic associated with the proposed Facility in the vessel corridor could result in increased levels of underwater noise. Pinnipeds could be encountered through the entire length of the vessel corridor, while whales would only be encountered in the marine environment.

Most sounds generated by large vessels are a source of low-frequency sound in the 0.005 to 0.5 kHz range (NMFS 2008b). Vessel movement to and from the proposed Facility would occur within existing designated shipping lanes, which are characterized as having high levels of use by both commercial and recreational vessels. Noise associated with vessels calling at the proposed Facility would likely cause low-frequency transitory peaks to background noise levels, but would not likely contribute a significant increase in ambient noise within the vessel corridor study area.

Pinnipeds have sensitive hearing across fairly wide frequency bands, with a range from approximately 0.05 to 50 kHz and underwater peak sensitivity occurring in the 1 to 25 kHz range (Kastelein et al. 2005, Okeanos 2008). Little information is available on sea otter hearing sensitivity, although studies have documented mother and pup calls ranging from 3 to 5 kHz, with the probability that some calls reach higher frequencies (Sandegren et al. 1973). While vessels and tugs associated with the proposed Facility would generate some broadband noise in the hearing range of pinnipeds, the majority of energy would be below their peak hearing sensitivity (1 to 25 kHz), thereby reducing the possibility of affecting these species. If any pinnipeds were present in areas that experience elevated noise levels, the duration of their exposure would be limited to the relatively brief period when the vessel is nearby.

Baleen whales are sensitive to low-frequency noise occurring in the 0.01 to 1 kHz range (Okeanos 2008). Should baleen whales be present in the marine portion of the vessel corridor study area, the duration of their exposure to vessel noise would be limited to the brief period when the vessel is nearby. However, many vessels of all types transit through the offshore marine areas and the increase in vessels associated with the proposed Facility in these areas would not cause long-term alteration of background noise levels.

Most toothed whales hear in a frequency range that extends from 1 to at least 120 kHz, but they are most sensitive to noise in the range of 18 to 42 kHz (Szymanski et al. 1999). While vessels and tugs associated with the proposed Facility would generate some broadband noise in the hearing range of toothed whales, the majority of energy would be below their peak hearing sensitivity (18 to 42 kHz), thereby reducing the potential to affect these species. If any toothed whales were present in marine areas of the vessel corridor that experience elevated noise levels, the duration of their exposure would be limited to the brief period when the vessel is nearby.

The increase in vessel traffic associated with proposed Facility operation could lead to an increase in low-frequency noise. However, the effect of an increase in low-frequency noise on pinnipeds, sea otters, or baleen or toothed whales would be minor because vessels are transitory and exposure would be limited to the period when the vessel is nearby.

Vessel Disturbance and Strike

Increased traffic associated with the proposed Facility could result in marine mammal strikes in the vessel corridor. Pinnipeds could be encountered through the entire length of the vessel corridor, while whales would only be encountered in the marine environment.

Collisions between pinnipeds and large vessels are unlikely as pinnipeds are typically vigilant and able to avoid collisions. However, pinnipeds could be disturbed by transiting vessels while at haulout sites. Calkins and Pitcher (1982) found that disturbances from vessel traffic cause extremely variable effects on hauled-out sea lions, ranging from no reaction to complete and immediate departure from the haulout. Increased vessel traffic associated with the proposed Facility could lead to an increased disturbance of pinnipeds, which could result in behavioral effects. Changes in vessel traffic could affect foraging behavior, but little data exist to determine the relevance to pinnipeds. In addition to directly affecting foraging behavior, pinnipeds could be indirectly affected if schools of forage fish change their behavior due to changes in vessel traffic. However, it is not likely that the increase in vessel traffic associated with the proposed Facility would substantially disrupt normal behavior patterns of pinnipeds or their prey. Therefore, potential impacts to marine mammals from vessel disturbance and strike would be negligible.

Whales are vulnerable to collisions with all vessel types, sizes, and classes. Most reports of collisions involve large whales, although collisions with smaller species also occur ((Jensen and Silber 2004). Vessel strikes occur when either the whale or vessels (or both) fail to detect the other in time to take avoidance action. Variables that make collisions between whales and vessels more likely include vessel speed, type, and size. The probability that the collision between a whale and a vessel would cause a fatal or serious injury increases with speed. If a nursing female is injured or killed it could result in indirect mortality of a calf.

Whales struck by vessels traveling at speeds less than 13 knots are more likely to survive than when struck by a vessel traveling at speeds greater than 13 knots (Jensen and Silber 2004). The highest incident rate for reported collisions between vessels and whales is for Navy vessels (17.1 percent), while tankers are responsible for only 6 percent of known vessel strikes (Jensen and Silber 2004). A review of the NMFS Large Whale Ship Strike Database (Jensen and Silber 2004) found no instances of ship-struck whales in the vessel corridor study area between 1975 and 2002. The low probability of a vessel strike combined with the small change in overall vessel traffic calling at the proposed Facility would result in a negligible impact to whales.

Marine Turtles

Adult leatherbacks turtles could be present in the vessel corridor study area during the summer and fall when jellyfish aggregate off the Columbia River mouth. Potential effects to leatherback turtles from vessel traffic associated with the proposed Facility include vessel strikes and increased noise.

Vessel Strikes

Vessel traffic transiting the marine portion of the vessel corridor could strike or disturb leatherback turtles feeding or swimming at or below the surface of the water. However, vessels would be moving at low speeds and leatherbacks would be able to detect them and move out of their path (2007). Therefore, the potential for vessel strikes of marine turtles would be negligible.

Noise

Leatherback auditory sensitivity is not well studied, although a few investigations suggest that their hearing is limited to low-frequency bandwidths (Lenhardt 1994, Moein et al. 1994). Generally, sea turtles respond to low-frequency sounds, but with less sensitivity than mammals (McCauley et al. 2000, URI 2013). It is currently believed that the range of maximum sensitivity for sea turtles is 0.20 to 0.80 kHz, with hearing below 0.080 kHz less sensitive but potentially usable to the animal (Lenhardt 1994, Moein et al. 1994). Vessel sounds attributed to vessels and tugs traveling to and from the proposed Facility would generate low-frequency sound in the 0.005 to 0.5 kHz range (NOAA 2008). The role of underwater hearing in sea turtles is unclear (URI 2013); however, it is possible that noise from increased traffic could mask biologically significant sounds. The increase in vessel traffic due to proposed Facility operation could lead to a slight increase in associated low-frequency noise but would be unlikely to adversely affect leatherback turtles due to the transient nature of the vessels, which would not cause long-term alteration of background noise levels. Therefore, noise impacts to marine turtles would be minor.

Invertebrates

The vessel corridor study area is home to a diverse and extensive invertebrate population, both in the marine and freshwater environments. It is possible that entrainment could occur during the invertebrate pelagic larval stage. The duration of the pelagic larval stage varies by species and ranges from a few weeks to a few months. During this stage, free-floating larvae would be present in the water column and could become entrained by passing vessels, although effects would be limited to the time when larvae are present in the vessel corridor study area. Vessels currently travel up and down the Columbia River and entrainment impacts to eggs and larval fish are currently ongoing. Entrainment is not restricted to deep-draft vessels, so the increase of one vessel (two trips) per day associated with the proposed Facility would not be a large increase over baseline conditions. Because of the small increase in Project-associated vessel traffic compared to average total traffic, the potential for Project-associated entrainment to adversely affect the reproduction, population size, or distribution of invertebrate species in the vessel corridor study area would be negligible.

3.6.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port and the following impacts to aquatic resources from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to aquatic species beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Impacts to aquatic species from construction of these facilities would depend on the type of facility developed at the site and may include loss or alteration of habitat from modifications that occur in-water, temporary degradation of water quality from increased sediment releases, noise disturbance from construction, including vibratory (in-water) and impact pile driving (dry land), or equipment operation that can disturb and displace aquatic species, and small spills or leaks of fuel, hydraulic fluids, or oil from construction equipment.

  Impacts from operation of a different facility under the No Action Alternative would likely be similar to those of the Proposed Action. Such impacts may include noise and lighting impacts, entrainment in vessel intakes, alteration of habitat through vessel wakes, impairment of fish access to or through shoreline habitat, and reductions in water quality from leaks of fuel, crude oil, and other fluids. In the event that vessels are used to transport goods through the Columbia River, such vessels could be affected by increased noise and disturbance generated by vessels, habitat disturbance from vessel wakes, wake stranding of fish, and vessel strikes. Each of the facility types that could be constructed at the Port would have a different set of aquatic resources impacts. For example, a facility that used smaller vessels would generally be expected to have less impacts to aquatic species than a facility with larger vessels. However, without knowing which facility, if any, would be constructed at the Port, it is not possible to quantify impacts.

3.6.5 Mitigation Measures

The design features and BMPs the Applicant proposes to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to aquatic species in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce impacts to aquatic species:

- Install erosion control barriers (silt fencing with filtration fabric keyed in at ground surface; possibly straw wattles) during installation of ground improvements at the marine terminal at the top of the embankment to prevent flow of silt-laden water from stone column installation into the Columbia River.
- Install monitoring wells downslope from stone column and jet grout column installation areas to monitor water quality during the installation of ground improvements to detect high pH or high sulfate content water that could be generated during installation.
- Perform all construction activities below the OHWM during the EFSEC modified in-water work window of September 1 through January 15 to avoid peak migration and larval stages of salmonid and nonsalmonid species (especially eulachon and white sturgeon) in the proposed Facility study area.
- Modify the walkways and trusses for the proposed dock modifications to use steel grating designed to let at least 60 percent of sunlight penetrate into areas over shallow-water habitat and use retractable shore-based walkways that would be in place only during periods when vessels are moored.
- Develop mitigation for wake stranding and wake effect impacts in consultation with appropriate state and/or federal agencies. Examples might include the addition of fine-scale beach features such as strategically placed logs or vegetation in susceptible areas to provide refuge from wakes for habitat types important to juvenile fish.
- Reduce vessel transit speeds in areas that are more susceptible to wake stranding of juvenile fish due to shoreline geomorphology (e.g., near Sauvie Island; ENTRIX 2008).
- Make immediate notification to the Washington Military Department’s Emergency Management Division and to the WDFW Region 5 Habitat Program Manager if, at any time, as a result of proposed Project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills).
- Revise the MMMP to include two additional observers to assist in monitoring the 6-mile zone where marine mammals could be affected by in-water vibratory pile driving.
- Use only marine terminal loading area spot lighting during loading operations.

In the event that a Site Certification Agreement is granted for the proposed Facility, EFSEC would coordinate with appropriate agencies to review and revise the MMMP before construction begins to minimize impacts to marine mammals.

3.6.6 Significant Unavoidable Adverse Impacts

Overall, noise impacts to aquatic species (fish and pinnipeds) from noise generated by pile driving would be temporary but moderate.

Impacts to water quality from increased turbidity and hazardous material contamination during construction are expected to be minor to moderate.

The increase in deep-draft vessel traffic associated with the proposed Facility could result in a moderate to major long-term effect on nearshore fish including listed salmonids and eulachon species in the lower 33-mile portion (16 percent) of the Columbia River.

The increase in deep-draft vessel traffic and associated increase in vessel wakes could reduce vegetation communities, resulting in a moderate to major long-term change to the resource, indirectly affecting fish species that rely on these habitats to complete their life cycle. The increase in deep-draft vessel traffic and associated increase in vessel wakes could result in a moderate to major long-term change to tidal wetland, shallow water, and tidal flat EFHs.

The approximately 223 percent increase in deep-draft vessel traffic associated with the proposed Facility could result in a moderate to major long-term effect on nearshore fish in the lower 33-mile portion of the Columbia River.

3.7 ENERGY AND NATURAL RESOURCES

This section describes the estimated electricity, fossil fuel, and construction material requirements for the proposed Facility and assesses the availability of local resources to accommodate the requirements. The use of fuel for unit trains and vessels associated with the proposed Facility is discussed.

3.7.1 Methods of Analysis

The analysis of impacts to energy and natural resources considered impacts from proposed Facility construction and operations, including alterations in the availability of electricity, gasoline and diesel fuel, natural gas, and construction materials. The analysis of impacts also considered impacts from rail transportation, including increased emissions during locomotive idling and changes in the availability of materials for repair and construction of rail tracks. Impacts from vessel transportation included an examination of the availability of bunker fuels in the region.

Study areas used in the analysis of energy and natural resources include:

- The electricity service territory of Clark Public Utilities
- The natural gas service territory of NW Natural
- Regional supplies of gasoline, diesel, and natural gas
- Construction material resources within Clark County[1]
- The rail corridor from the proposed Facility to Williston, North Dakota
- The vessel corridor from the proposed Facility to receiving refineries

Information on energy supply, availability, and resource mix sources was obtained from NW Natural, CPU, and Washington Department of Commerce. Information on the presence of construction material resources was obtained from the WDNR and the Clark County Comprehensive Growth Management Plan. Information on the consumption of sand, gravel, and aggregate resources was obtained from a representative from Washington Aggregates and Concrete Association (Chattin, pers. comm., 2015).

Estimates of electricity and fuel consumption during construction of the proposed Facility were calculated by the Applicant from 30 percent design drawings using standard estimating techniques and CAD drawings. The process of developing a project includes different levels of design that increase in detail as more information is gathered and used (e.g., 30, 50, and 90 percent designs). Typically, 30 percent design drawings provide detailed information on existing conditions and project design and are appropriate to use in assessing the types and quantities of equipment and materials that would be required to construct a project. The Applicant provided EFSEC with a workbook detailing the 30 percent design calculations and associated assumptions, which was reviewed; relevant information was incorporated into this Draft EIS. Updated estimates of the amount of construction materials that would be required at the proposed Facility site were provided by the Applicant after further development of proposed ground improvements. Estimates of natural gas, fuel, and electricity consumption during operation and maintenance of the proposed Facility were based on industry average use for the Facility design.

1 The geology of Clark County is favorable for large sand and gravel resources and bedrock aggregate resources (Johnson et al. 2005).

3.7.2 Affected Environment

3.7.2.1 Proposed Facility

Electricity

CPU provides electricity to the Port generated mostly from hydroelectric facilities (58 percent in 2013) and natural gas-fired power plants (35 percent in 2013) (Washington Department of Commerce 2015). Hydropower is obtained through purchase agreements with Bonneville Power Administration, and the 248 MW River Road Generating Plant in Vancouver is the main source of energy generated from natural gas. Total energy supplied by CPU in 2013 was 4,642,556 megawatt hours (Washington Department of Commerce 2015). CPU's base case forecast of future energy demand assumes an average annual growth rate of 1.1 percent over the next 20 years, which translates to an increase in annual average demand of 120 megawatts between 2014 and 2033. The utility generally has sufficient capacity to meet the forecasted increase in annual average demand, but has both an immediate and long-term need to incorporate additional conservation measures and new supplies to meet peak demand requirements (CPU 2012).

A CPU substation is planned for construction in the vicinity of the JWC.[2] CPU has indicated that substation construction could be completed approximately 1 year after the Port and CPU commit to building the new substation (Blaufus, pers. comm., 2015) and when all required permits have been obtained.

Gasoline and Diesel

The transportation sector accounted for nearly 80 percent of petroleum products consumed in 2012 in the United States (EIA 2014a). Petroleum products remain the largest primary energy source in Washington State although per capita consumption of refined petroleum products has declined in part due to an economy operating at reduced output and employment, higher fuel prices, and increased fuel economy standards for light duty vehicles (Washington Department of Commerce 2015).

Washington has five refineries that supply gasoline for automobiles, clean diesel for trucks, and fuel for the ferry and shipping fleet. Most of these refineries also produce jet fuel and Washington is among the top 10 states in the nation in the consumption of jet fuel, having several large US Air Force and US Navy bases located in the state that contribute to its consumption. Motor gasoline is produced at all of the state's refineries and accounts for almost half of Washington's consumption of petroleum products. Washington's refineries produce more refined product than is consumed within the state; approximately 39 percent is consumed in Washington. In 2011, approximately 35 percent of the combined refinery output was sent to domestic consumers, mainly in Oregon and California, and approximately 14 percent was shipped to foreign consumers, mostly to British Columbia.[3] Yellowstone Pipeline, which originates near Billings, Montana, and Chevron Pipeline, which originates in Utah, import about 12 percent of the state's refined product, primarily for use in eastern Washington.

Natural Gas

NW Natural provides natural gas service to the Port via existing distribution pipelines. NW Natural provides natural gas distribution services to nearly 700,000 customers in their service territory, which includes the Portland-Vancouver metropolitan area, Willamette Valley, much of the Oregon Coast, and a portion of the Columbia River Gorge. Approximately 10 percent of NW Natural's customers reside in Washington, primarily within Clark County. Residential customers comprise roughly 90 percent of the customer base. NW Natural has experienced recent growth in demand growth from a strong local

2 This CPU substation was planned to serve the Port and is not a connected action to the proposed Facility.

3 British Columbia has two small refineries but also has to import refined product.

economy and housing market and from the relative attractiveness of natural gas versus alternate heating fuels (electricity, oil, etc.) in home fuel conversions (NW Natural 2014). NW Natural anticipates an increase in regional natural gas demand, primarily from the industrial and power generation sectors and additional gas infrastructure will need to be developed over the next 5 to 7 years to accommodate this demand (NW Natural 2013).

NW Natural's annual base case firm load (including residential, commercial, and industrial uses, but excluding firm transportation users) for the period 2013-2014 is estimated at 7,380.33 (million dekatherms [MMDT]) at the Vancouver hub and 76,865.03 system-wide (NW Natural 2013). Industry usage for the same forecast period is 308.91 MMDT at the Vancouver hub and 3,282.86 system-wide.

In the vicinity of the proposed Facility, NW Natural has identified an immediate resource deficiency in both the supply and the distribution system in the Vancouver load center. To remedy this deficiency, distribution system upgrades are needed in Vancouver/Clark County as soon as is feasible (NW Natural 2013). NW Natural has launched several projects to strengthen the distribution system capacity in Clark County over the next few years to serve the load forecasted in their 2014 Integrated Resource Plan (Lange, pers. comm., 2015).

Construction Materials

Consumption of construction materials in Clark County is primarily related to construction projects requiring sand, gravel, steel, aluminum, concrete, and other building products. Clark County has 27,729 acres of identified gravel resources and 7,297 acres of bedrock resources (WDNR 2005). The most abundant gravel deposits lie in the southern portion of the county (Orchards, East Mill Plain) (Clark County 2012). While available geologic data suggest rock aggregate resources are plentiful in Clark County, not all of these resources can necessarily be developed due to environmental and other constraints. According to Washington Aggregates and Concrete Association, mineral resources in the region are not rare but are becoming more difficult to access due to permitting needs and conflicts with current land use. Clark County is updating its mineral resource land policies, regulations, and overlay as part of the 2016 update to the County's Comprehensive Growth Management Plan required by Washington's Growth Management Act. The County has designated mineral resources lands as required by Washington's Growth Management Act (RCW 36.70A), and the City of Vancouver has designated one site as mineral resources lands located east of 172nd Avenue (VMC 20.540.020). In total, 34 entities have Sand and Gravel General Permits from Ecology in Clark County (Ecology 2014).

3.7.2.2 Rail Transportation

Electricity

Incidental use of utilities occurs during operation of the rail corridor through the provision of electricity for operation of automated signals.

Diesel

Railroad-related diesel fuel sales in the states crossed by the proposed rail corridor in 2012 were as follows (EIA 2014b):

- Washington: 88,364 thousand gallons
- Idaho: 25,068 thousand gallons
- Montana: 41,901 thousand gallons
- North Dakota: 43,907 thousand gallons

Diesel fuel is the primary fuel source for freight (and passenger) locomotives in Washington and represents approximately 9 percent of total diesel sales in the state. Highway users (e.g., trucks) were the largest end use category, accounting for 62 percent of diesel sales in Washington in 2012 (EIA 2014b).

3.7.2.3 Vessel Transportation

Bunker Fuel

Large ships are often run on low-quality fuel oils, such as bunker oil. Bunker oil traditionally has been heavy, higher sulfur residual fuel oil. Vessel bunkering[4] occurs in the Columbia River at berths and designated anchorages including anchorages in Astoria, Longview, Cottonwood Island, Kalama, Woodland, Willow Bar, and Hayden Island (Lower Columbia Region Harbor Safety Committee 2013).

3.7.3 Impact Assessment

3.7.3.1 Proposed Facility

Construction

Electricity

Construction would consume electricity to provide temporary construction site lighting, heat buildings, and power tools and equipment. Often, contractors do not require utility power at the site and rely on generators to supply electricity. Estimated electricity consumption for construction of the proposed Facility is approximately 5 to 10 percent of that required during operation (Gray, pers. comm., 2015), or between approximately 11,555 and 23,110 kilowatt-hours per day. CPU would likely have the ability to meet this construction load requirement using its existing electrical distribution infrastructure (Blaufus, pers. comm., 2015). Construction of the proposed Facility would, therefore, have a negligible impact to local electricity supplies.

Gasoline and Diesel Fuel

Petroleum products including gasoline and diesel fuel would be used to power portable generators, construction vehicles, and other construction equipment. Gasoline and diesel fuel would likely be sourced from local gas stations and the amount required would not affect other users. The amount of transportation-related petroleum products consumed would be similar to other medium-sized industrial construction projects and would have a negligible impact to regional supply.

Natural Gas

Existing 2-inch service lines are present at the site of the proposed boiler building (Area 600). During Facility construction, the 2-inch-diameter line to the boiler building would be upgraded to a 4-inch-diameter service line and the existing 2-inch-diameter service line to the JWC would be extended farther south toward Berths 13 and 14 to provide gas for the MVCU system.

Minimal to no natural gas consumption would be associated with construction of the proposed Facility so no impacts would occur to the ability of NW Natural to meet the load requirements of its service area.

Construction Materials

Construction of the proposed Facility would require the following materials:

4 “Bunkering” is a term used for fueling vessels.

- Approximately 18,500 tons of steel to construct ground improvements (pilings), building structures, siding and roofing, storage tanks, piping, operations access structures (catwalks and gangways), rail loops, and dock improvements.
- Approximately 9,800 cubic yards of gravel to produce concrete.
- Approximately 160,000 cubic yards of aggregate for ground improvements.
- Approximately 18,000 tons of cement for ground improvements.
- Approximately 8,437 cubic yards of concrete to construct piping trenches, containment basins, building foundations, equipment pads, and storage tank foundations.
- Approximately 17,500 cubic yards of rail ballast for construction of two rail loops.
- Approximately 227,000 cubic yards of materials for berm construction. To the extent possible, ground materials and soils excavated in other areas at the site (e.g., trenches in the railcar unloading facility) would be used to construct the storage tank containment berm, although not all excavated materials may be suitable for this use.
- Approximately 1,000 cubic yards of asphalt would be required to construct new hard surfaces planned throughout the proposed Facility, including hard surfaces between rail tracks in the railcar unloading facility and for parking areas.

The shifting of existing Tracks 4106 and 4107 would require the placement of approximately 6,163 cubic yards of new track ballast (BergerABAM 2015), and additional materials for subballast and site preparation may be required. Construction of the new track (4101) would require approximately 4,563 cubic yards of new track ballast and approximately 262 tons of steel for new rails.

Relocation of the natural gas pipeline in the vicinity of the proposed boiler building would require steel piping materials. Pipeline construction is expected to include excavation and backfilling using native materials with no additional aggregate requirements. Construction of these improvements would also require additional use of energy in the form of gasoline and diesel fuel to power machinery used during construction.

At this time, the quantities of construction materials needed to construct the proposed Facility could reasonably be attainable from local sources within Clark County (Chattin, pers. comm., 2015) and would, therefore, have negligible impacts to regional resources.

Operation and Maintenance

Electricity

Electricity demands during operation of the proposed Facility would be similar to other large industrial facilities. Electricity would be used to light indoor and outdoor areas, heat indoor spaces, and power pumps, equipment, control systems, and storage tank heaters. Load requirements at full operation of the proposed Facility are estimated to be approximately 231,100 kilowatt-hours per day. This electricity demand could be met with supplies available within the region but local infrastructure to supply energy to the proposed Facility is inadequate. CPU does not currently have the ability to serve this load increase at this location, but a new substation in the JWC vicinity has been permitted that would serve multiple customers at the Port. Construction of this new CPU substation is not dependent on development of the proposed Facility. Work on the substation has not yet begun and would likely take 1 year to construct. Once operational, CPU would have the ability to serve the load requirements of the proposed Facility (Blaufus, pers. comm., 2015). The increased electrical capacity from the proposed new CPU substation would ultimately benefit multiple local end users. Electricity requirements of the proposed Facility would, therefore, have no adverse impacts to other electricity users.

The Applicant has proposed the following conservation measures:

- Installation of high-efficiency electrical fixtures, appliances, and light bulbs in the support/administrative building
- Installation of light-emitting diode light bulbs throughout the Facility
- Use of vehicles that comply with current fuel consumption and emission standards

These measures are considered to be part of the proposed Project.

Gasoline and Diesel Fuel

Petroleum products including gasoline and diesel would be used to fuel maintenance vehicles, switching locomotives, and fuel-powered maintenance equipment. Low sulfur diesel would be used for testing of emergency fire pumps. It is estimated that normal maintenance and testing of fire pumps would consume approximately 1,250 gallons of ultralow sulfur diesel per year. The amount of petroleum products consumed would be similar to other medium-sized industrial projects with rail activities and would have a negligible impact to regional supply.

In the event of a power failure for any reason, leased portable power generators (i.e., emergency engines) would be activated to operate critical safety, security, and environmental equipment. The emergency engines would be fueled by ultralow sulfur diesel or biodiesel.

Natural Gas

Natural gas would be used to power the boilers (0.1852 million standard cubic feet [MMscf] per hour) and the MVCU and vapor blower skid (0.0305 MMscf per hour) at the marine terminal. Natural gas consumption at full capacity operation of the proposed Facility would be approximately 1,188,576 million British thermal units (i.e., approximately 1.189 million MMBTU or 1.189 MMDT) per year or 1,189 million cubic feet per year. This amount would represent approximately 0.4 percent of NW Natural's industrially based consumption at the Vancouver hub; 0.04 percent industrially based, system-wide; and 0.0015 percent of all firm consumption (excluding transportation-related) system-wide.

NW Natural's existing gas mains in the Port vicinity can currently provide interruptible service to the loads required by the proposed Facility natural gas-fired boilers and MVCUs (Chang, pers. comm., 2015). Therefore, no impacts to NW Natural's ability to serve the load requirements of its service area are expected.

Construction Materials

Consumption of construction materials during operation and maintenance of the proposed Facility would be minimal and mainly used to maintain some facility elements built during the construction phase. For example, repair of concrete flooring or parking areas or replacement of columns or support structures would require concrete, asphalt, or steel resources. Since only small amounts of such materials would be required, no impacts to local supplies would occur.

Decommissioning

Decommissioning would consume electricity to power tools and equipment, which could be used from onsite sources or from portable generators. Gasoline and diesel would be required to power portable generators, construction vehicles, and other construction equipment and would likely be sourced from local gas stations. Natural gas would not likely be used during decommissioning, and the relocated and extended natural gas pipeline constructed at the proposed Facility site would remain in place. Some construction materials may be required, for regrading in areas with demolished structures for example. The amount of electricity, gasoline, diesel, and construction materials used during decommissioning would be less than during construction, resulting in negligible impacts to local and regional energy and natural resource supplies.

3.7.3.2 Rail Transportation

The existing utility infrastructure throughout the region is sufficient to provide service for the incidental use of electricity for operation of signals along the rail corridor.

Diesel fuel sourced from areas along the rail corridor would be required to power locomotives to move the train but would not impact the availability of fuel for other uses. Locomotive fuel economy is expected to improve in the future as a result of various regulatory programs, including EPA emissions standards and programs designed to reduce locomotive engine idling (EPA 2013). EPA requires equipping all newly manufactured and nearly all remanufactured locomotives with idle reduction technology that automatically shuts locomotives down if left idling unnecessarily, which reduces fuel consumption. Fuel economy would likely improve as a result of retiring or rebuilding older engines.

Construction materials would be used in the maintenance of rail tracks along the rail corridor, which would occur regardless of whether the proposed Facility is constructed and operated. However, maintenance activities could increase in frequency from the addition of more trains along the segments used by trains associated with the proposed Facility. Construction materials used in the maintenance of rail tracks along the rail corridor are assumed to generally consist of small volumes of material sourced locally. As such, impacts to energy and natural resources from trains associated with the proposed Facility would be negligible.

3.7.3.3 Vessel Transportation

Vessels would not be bunkered at the proposed Facility. Since no storage or vessel-fueling capabilities are planned as part of the proposed Facility and the Applicant has stated that it would not permit bunkering at the Facility dock, it is assumed that bunkering would occur elsewhere. Further, it is assumed that bunkering would most likely not take place in the Lower Columbia River, but rather at the refineries in the Puget Sound and/or California receiving crude oil shipments, or at anchorages in Puget Sound, California, Alaska, or even Hawaii, depending on the voyage of the specific vessel involved. The one vessel (two trips) per day associated with the proposed Facility would not likely impact the availability of bunker fuels in the region. Impacts to energy and natural resources from vessels associated with the proposed Facility would be negligible.

3.7.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to energy and natural resources from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue. No use of energy and natural resources would occur beyond that required for current activities at the site, such as fuel required for maintenance vehicles and equipment. Construction of the CPU substation, which would serve multiple customers at the Port, is anticipated (and is not a connected action to the proposed Project).
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Construction, operation and maintenance, and decommissioning activities for such facilities would likely result in similar requirements for energy and natural resources as the proposed Facility, resulting in negligible to minor impacts to local and regional supplies of

electricity, fossil fuels, and construction materials under the No Action Alternative. The CPU substation is anticipated to be constructed and would likely be able to serve the electricity needs of a different facility at the site without adverse impacts to other users.

3.7.5 Mitigation Measures

The design features and BMPs the Applicant proposes to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to energy and natural resources in this Draft EIS. EFSEC has identified the following additional mitigation measure to reduce impacts to energy and natural resources:

- Coordinate with NW Natural to perform a site-specific evaluation to determine the actual physical and financial aspects required for NW Natural to serve the proposed Facility.[5]

3.7.6 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts have been identified for energy and natural resources.

5 Although no impacts to NW Natural's ability to serve the load requirements of its service area are expected, NW Natural has recommended completing a site-specific evaluation to determine the actual physical and financial aspects required for NW Natural to serve the proposed Facility given its large natural gas consumption at full capacity operation (Chang, pers. comm., 2015).

3.8 ENVIRONMENTAL HEALTH

This section describes a range of environmental health concerns related to construction, operation and maintenance, and decommissioning of the proposed Facility and also from the transportation of crude oil by trains and vessels. The analysis of environmental health includes the consideration of the health and safety risks to workers and the surrounding community, including information about the site security measures and hazardous materials used at the facility. In addition, this section discusses the potential for disturbing, during construction, existing onsite contaminated areas that are currently protected by engineered caps. The potential health and safety issues associated with an accidental release of crude oil (either onsite or along the transportation corridors) and an associated fire and/or explosion are described in Section 4.6.

3.8.1 Methods of Analysis

The analysis of impacts to environmental health considered impacts from Facility construction and maintenance, including occupational and worker safety risks, site contamination, and site security. Potential impacts from rail and vessel transportation were also considered, including accidents and fatalities of workers and members of the public along the rail corridor, at road crossings and from vessel collisions. The timeframe for analysis of environmental health impacts includes construction, operation and maintenance, and decommissioning (a period of approximately 20 years).

The study areas for assessing impacts related to environmental health include:

- **The proposed Facility study area**—the Port of Vancouver and the community surrounding the Facility within an approximate 0.5-mile radius
- **The rail corridor study area**—communities along rail routes that would be used by trains associated with the proposed Facility.
- **The vessel corridor study area**—the Columbia River between the Port and the Pacific Ocean and offshore areas in the Pacific Ocean along the western United States.

Information provided by the Applicant regarding public health and safety included descriptions of proposed Facility components and operations and assessments of public health and safety issues. This information was reviewed for completeness and accuracy and compared to standards and guidelines to assess the effectiveness of risk reduction measures with regard to Facility construction, operations and maintenance, and decommissioning. Additional measures to reduce risk were identified and are presented in Section 3.8.5. Data on railroad-related fatalities and vessel collisions were obtained to analyze existing safety conditions and trends (UTC 2014, BergerABAM 2014).

3.8.2 Affected Environment

This section describes the existing health and safety environment at the proposed Facility site and Project vicinity and along associated rail and vessel corridors to provide a baseline for assessing potential impacts to environmental health.

3.8.2.1 Proposed Facility

The Proposed Action would be located within the Port of Vancouver in an area that is zoned Heavy Industrial. As expected in an industrial environment, numerous existing Port tenants, and other private landowners interspersed within Port-owned lands, conduct industrial activities, some of which involve the receipt, handling, shipping, or use of hazardous materials. Light industrial facilities surround and are interspersed within the larger industrial operations listed above. The public is generally excluded from access to active industrial areas at the Port, with access limited to persons working or conducting business at these locations. The Applicant expects that construction of the proposed Facility would require 239 onsite and offsite employees, and operation of the proposed Facility would require 320 onsite and offsite employees. Currently, over 2,000 people are directly employed by businesses at the Port (2015).

The JWC is located east of NW Gateway Avenue, north of the marine terminal (Area 400) and south of the main Port rail access spur (Figure 2-1). The JWC contains in-custody and work release buildings and housing units with approximately 200 beds. At present, the JWC accommodates 90 residents who are typically housed for approximately 18 days (Bishop, pers. comm., 2015). The nearest residentially zoned area is located in the Fruit Valley neighborhood, which is 0.6 mile from the location of the proposed storage tanks. Motorists travel along SR 501 adjacent to the proposed Facility location, and vessel traffic occurs on the Columbia River. Sidewalks and the Lower River Road bicycle trail provide pedestrian and bicycle access along SR 501.

Occupational/Worker Safety

The Applicant proposes to construct and operate the Facility to comply with the occupational safety and health regulations in the WISHA (RCW 49.17). The state regulations conform with the federal Occupational Safety and Health Administration (OSHA) standards to protect employees against material impairment of health and functional capacity due to occupational exposure to hazards. Primary safety regulations applicable to the activities that would be conducted at the proposed Facility under applicable state and local regulations and codes include, but are not limited to, the following:

- WAC 296-24, General Safety and Health Standards
- WAC 296-56, Safety Standards—Longshore, Stevedore and Waterfront-Related Operations
- WAC 296-62, Occupational Health Standards
- WAC 296-800, Safety and Health Core Rules
- WAC 296-841, Airborne Contaminants
- WAC 296-824, Emergency Response
- WAC 296-860, Railroad Clearances and Walkways in Private Rail Yards and Plants
- WAC 296-901, Globally Harmonized System for Hazard Communication

Examples of environmental factors that can impact worker health and safety include unsafe equipment, inadequate site traffic controls, lack of training and awareness, and/or worker fatigue (OSHA 2014). The Bureau of Labor Statistics reported that 88 fatalities in the marine-cargo-handling industry occurred from 2005 through 2012. Of these 88 fatalities, 52 were the result of accidents involving mobile port equipment (e.g., forklifts) (OSHA 2014).

Existing Site Contamination

At the proposed Facility site contamination exists from the Alcoa/Evergreen aluminum smelter that operated there until 2000. Industrial and solid wastes from the construction and operation of the aluminum smelter were stored in waste piles that included petroleum hydrocarbons, PCBs, cyanide, fluoride, TCE, low-level organic chemicals, and metals. In 2009, Alcoa/Evergreen completed site remediation and facility decommissioning under Ecology Consent Decree No. 09-2-00247-2 and Enforcement Order 4931. Remediation and decommissioning required removal of structures and foundations to about a 4-foot depth and removal of contaminated soil and sediment with hazardous chemical concentrations above the levels established by the Consent Decree (Ecology 2008). The proposed Facility area is also subject to environmental restrictive covenants listed in the Consent Decree.

As part of the Proposed Action, activities occurring at six locations at Terminal 5 would be subject to the Ecology Consent Decree and the environmental restrictive covenants:

- A portion of the unloading and office area (Area 200) would occur at the location of the Vanexco cap. Dewatering may be necessary during excavations for Area 200 structure foundations, trenches, and pump basins, as well as some localized installation of utilities and short lengths of transfer pipelines routed under existing roads and rail.
- Portions of the two new rail loops and the connected action related to shifting existing rail loops would occur at the North/North 2 Landfill site, the Spent Pot Liner (SPL cap), the Shoreline Restrictive Covenant Area, and the Ingot Plant Cap.
- A portion of the extension of NW Gateway Avenue would occur at the East Landfill location.

Table 3.8-1 provides a summary description of the remediation actions at each location and the regulatory or cleanup status of these sites. Figure 3.8-1 shows the approximate Terminal 5 locations where restrictive covenants are in place and the portions of the Proposed Action that would be located in these protected areas.

Hazardous Materials

Hazardous materials used during construction and operation would be typical of a large, industrial site. In addition to the crude oil handled during operations, fuels such as gasoline and diesel would be used to power mobile construction equipment; maintenance of such equipment could require the use of lubricants, oils, and antifreeze. Hazardous materials onsite could include used oil, spent antifreeze, unused adhesives, discarded water treatment chemicals and residuals, and spent lead acid batteries. During construction, solvents and paints would be used during assembly and surface finishing of Facility components. Small amounts of welding gases would be stored and used onsite to assemble metal structures and transfer pipelines.

Site Security

All Port operations are conducted in accordance with the Port’s security program. Access to the Port’s marine terminals is allowed primarily through the main security gate at the 26th Avenue overpass. The Port’s Security Plan and policies require that all people entering the Port’s terminal areas show photo identification and have a valid business purpose to access existing tenant operations. This requirement is accomplished through the Port’s screening process, administered to anyone who enters the Port’s marine terminals. In addition, Port general access areas are secured with fencing, video camera monitors, and 24/7 stationary and mobile patrols. All personnel who perform work (including contractors and consultants) within the Port’s maritime facility are required to have a Transportation Worker Identification Credential (TWIC) to perform their duties, or required to be escorted by a person who does have a TWIC. This program was established by Congress and is administered by the Transportation Security Agency and US Coast Guard (USCG). The Port provides lighting in roadway and common areas.

Table 3.8-1. Summary of the Deed-Restricted Areas at the Proposed Facility Site

Area	Summary	Contaminants of Concern*		Regulatory or Cleanup Status
		Soil	Groundwater	
Ecology/ALCOA Consent Decree 95-2-03268-4				
Vanexco Cap	PCB-impacted soil removal occurred in 1992. Groundwater monitoring from 1996 through 2001 indicated that groundwater is not affected by residual PCB-impacted soils. The building foundations and floor slabs were left in place to form a cap over the contaminated soils as required by the Consent Decree. Approximately 4 feet of surface material was placed above the foundation and is sloped to provide drainage away from the area or the foundation is replaced with an impervious layer and stormwater control facilities are located above the layer.	PCBs – (concentrations up to 2,000 ppm left in soil and 16,000 ppm in concrete pit chip samples left in place after EPA approval in 1992) and hydraulic oil (greater than 2,000 ppm. 9 feet bgs)	No chemicals of concern detected (depth ranges from approximately 15 feet to 25 feet bgs)	Deed-restricted site with no further remedial action required. The construction and groundwater monitoring portions of the Consent Decree have been completed. Ecology-approved disturbance of the Vanexco cap during rail improvement construction in 2009.
Ecology/ALCOA Consent Decree 92-2-00783-9				
Spent Pot Liner (SPL) Cap	A former EPA National Priority List site; 47,500 cubic yards of SPL and reclaimed alumina insulation were removed in 1992. The residual affected soils were capped with a HDPE cover. In 2010, the Port placed a specially engineered double-layered asphalt cap over the HDPE cover.	Cyanide (concentrations up to 491 mg/kg) and fluoride (concentrations up to 2,500 mg/kg) Potentially extending from the HDPE cover to approximately 15 feet bgs, the vertical point of compliance defined in the Final 2008 Corrective Action Plan	Fluoride (concentrations up to 27, [µg/L)	Deed-restricted area. No further remedial actions are required. The operation and maintenance activities consisting of groundwater monitoring, institutional controls, and cover maintenance continue. Ecology-approved disturbance of the SPL cap during rail improvement construction in 2009.
Ecology/Evergreen Enforcement Order 4931				
Ingot Cap	Approximately 14,000 tons of brick, concrete, and soil were removed and the area was covered with 1 foot of soil. Subsequently, the Port has placed additional material over the capped area to raise the site grade.	PCBs at concentrations less than 10 mg/kg are estimated to be present from 1 foot bgs to the depth of the groundwater surface, between approximately 15 and 25 feet bgs	None detected	Deed-restricted area. No further remedial action required.

Table 3.8-1. Summary of the Deed-Restricted Areas at the Proposed Facility Site

Area	Summary	Contaminants of Concern*		Regulatory or Cleanup Status
		Soil	Groundwater	
Ecology/ALCOA Agreed Orders DE90-I053 and DE03 TCPIS-5737*				
North/ North 2 Landfill	In 2004, approximately 38,000 cubic yards of contaminated soil at the North/North 2 Landfill site was removed and the area was covered with 1 foot of sand.	Concentrations likely present up to the following industrial ((MTCA) site soil clean levels: PCBs (up to 10 mg/kg), PAHs (20 mg/kg), VOCs (up to 0.03 mg/kg TCE) (estimated to be present from 1 foot bgs down to at least groundwater level)	VOCs (vinyl chloride at 3.3 µg/L), PAHs [benzo(a)-pyrene up to 0.30 µg/L] and PCBs (up to 2 ug/L). Groundwater level is estimated at 15 to 25 feet bgs.	Deed-restricted area with no further remedial action required.
Ecology/ALCOA Consent Decree 09-2-00247-2				
East Landfill	Contaminated material from the South Bank and North/North 2 landfills were placed into the East Landfill in 2003. A multilayer impermeable cap consisting of geosynthetic liner and a clay layer covered with HDPE, a synthetic drainage net, a 19-inch layer of compacted fill soil, a 6-inch layer of soil and vegetation was placed over the East Landfill in 2004. The shoreline adjacent to the East Landfill was armored to help stabilize the riverbank and engineered cap.	Lead, cyanide, fluoride, PCBs (concentrations exceeding 10 mg/kg), petroleum hydrocarbons, VOCs (concentrations potentially exceeding 0.03 mg/kg for TCE) and PAHs (concentrations potentially exceeding 20 mg/kg) (estimated present in soil below approximately 2 feet bgs)	VOCs: (TCE, vinyl chloride) (TCE concentrations up to 620 µg/L in the intermediate zone)	The area is capped and monitored for natural attenuation by conducting quarterly groundwater sampling.
Ecology/ALCOA Agreed Order DE97 TCI032				
Northeast Parcel	In 1997, approximately 12,000 tons of contaminated soil were removed from the Northeast Parcel. Confirmation soil samples indicated that the site was remediated in accordance with MTCA Method A unrestricted use soil cleanup levels. The area was covered with clean fill compacted, graded for proper surface water drainage, and vegetated.	PCBs, metals, and PAHs (estimated to be present below groundwater depth at concentrations less than MTCA Method A cleanup levels.	VOCs (vinyl chloride – 6.6 µg/L) Groundwater level is estimated at about 10 feet bgs	Remediated and covered; no further remedial action required.

*Anchor Environmental LLC 2008.

bgs = below ground surface, EPA = US Environmental Protection Agency, HDPE = high-density polyethylene, ug/L = microgram(s) per liter, mg/kg = milligram(s) per kilogram, MTCA = Model Toxic Control Act, PAHs = polycyclic aromatic hydrocarbons, PCBs =polychlorinated biphenyls, ppm = part(s) per million, TCE = trichloroethylene, VOCs = volatile organic compounds

Figure 3.8-1. Proposed Action Activities in Relationship to Areas Protected under Ecology Consent Decree and Restrictive Covenants

3.8.2.2 Rail Corridor

BNSF and other railroad employers are currently required to operate in compliance with the federal OSHA, FRA, and other standards designed to protect employees against material impairment of health and functional capacity due to occupational exposure to hazards.

Trespassing is the leading cause of rail-related injuries and deaths in the nation; approximately 500 fatalities and nearly as many injuries occur each year from trespassing (FRA 2015a). Most railroad trespassers are pedestrians who use railroad tracks as a shortcut. Combined, highway-rail crossing and trespasser deaths account for 95 percent of all rail-related deaths (FRA 2015a). Washington contains more than 3,000 miles of railroad tracks and has 186 at-grade crossings included in the National Highway-Rail Grade Crossing Inventory database (FRA 2015b). Over the 15 years from 1998 through 2013, 27 trespass fatalities have occurred along the rail corridor from the Washington-Idaho border to the Port of Vancouver (UTC 2014). These fatalities have mostly occurred at private crossings and in populated areas, with the majority occurring near Spokane, the Tri-Cities, and Vancouver. During the same period, seven motorist fatalities have been reported at at-grade crossings along the BNSF rail corridor from the Washington-Idaho border to the Port (UTC 2014).

As described in the *Washington State 2014 Marine and Rail Oil Transportation Study* (Ecology 2015), the Washington Utilities and Transportation Committee (UTC) looked at approximately 350 crossings to determine which crossings had elevated safety risks resulting from an increased potential for collisions between trains transporting crude oil and motor vehicles. The study focused on underprotected and/or passively controlled crossings where truck traffic accounts for more than 20 percent of annual average daily traffic, because semitrucks are capable of derailing a train in a collision in certain circumstances, and some of these vehicles may carry hazardous commodities (Ecology 2015). Based on the results of the study, UTC recommended conducting further discussions or a diagnostic review with BNSF for crossings along the rail corridor within Spokane, Cheney, Lyle, Pasco, Mesa, Bingen, and White Salmon to determine if these crossings are protected at the appropriate level. The “crossing exposure factor,” which is the number of trains per day times the number of vehicles using the crossing per day, is used to determine the appropriate level of protection at crossings. Increasing train traffic at these crossings would increase the crossing exposure factor, thereby increasing the chance that a collision may occur (Ecology 2015). Therefore, an increase in train traffic at a crossing may warrant a review of the level of protection at that crossing.

3.8.2.3 Vessel Corridor

Historic vessel collision data obtained from the USCG’s Marine Information for Safety and Law Enforcement (MISLE)[1] show a general downward trend in collision incidents in US waters occurred from 2002 to 2011 (BergerABAM 2014). The frequency of vessel collisions is dependent on a complex combination of factors related to characteristics of the vessels, degree of traffic, and conditions in the waterway and transit area (e.g., navigational issues, channel dimensions and configurations).

1 Statistics based on “Marine Casualty and Vessel Data for Researchers” issued by Homeport – US Department of Homeland Security - USCG.

3.8.3 Impact Assessment

3.8.3.1 Proposed Action

Construction

Occupational/Worker Safety

Occupational safety risks to proposed Facility construction workers would be managed through the implementation of safety and emergency plans. The Applicant's Health, Safety, Security, and Environmental (HSSE) Plan (included in Appendix D.11) outlines procedures to address site hazards including traffic hazards, proximal active rail lines, confined space entry, elevated work platforms, tool and equipment use, soil disposal, and hazardous materials handling. The Applicant has drafted a Construction Safety Plan that would apply to all personnel working at the proposed Facility. The Construction Safety Plan has been submitted to EFSEC for review to ensure compliance with all applicable laws, ordinances, regulations, and standards concerning health and safety. This plan includes a Job Hazard Analysis that identifies hazardous tasks or work activities that can expose employees to the risk of injury. Tasks and activities identified in the analysis would be addressed with special planning and training prior to construction of the proposed Facility. During construction, the safety manager would have the authority to issue stop work orders when employees violate health and safety procedures. Upon identification of a health and safety issue, the safety manager would work with the responsible site managers and employees to correct the issue. Workplace hazards would be controlled with lockout/tagout procedures, safe work practices, and the appropriate use of personal protective equipment (PPE), in accordance with applicable WISHA requirements. Construction site access would be limited only to authorized construction personnel; other Port tenant employees and the public would not have access to construction activities to prevent exposure to site-related occupational hazards. The Applicant has also developed a Construction Emergency Response Plan (Appendix D.13) to ensure employee safety from fire and other emergencies. This plan was developed in coordination with local emergency responders. The plan considers and prepares for unintended construction-site incidents that could spread beyond the construction-site boundary. Finalization of this plan would occur prior to construction of the proposed Facility. Employee training and the implementation of construction manuals and safety plans and procedures would reduce risks to proposed Facility construction workers, resulting in minor impacts to occupational health and safety during construction of the proposed Facility.

Existing Site Contamination

Disturbance of existing capped or contaminated areas during construction could lead to exposure of workers or the public to contaminated materials. However, the BMPs and requirements imposed by environmental covenants would reduce the likelihood of contaminated material from impacting workers and the public. The Applicant would require contractors to comply with the following requirements imposed by Ecology's environmental covenants to minimize the disturbance of existing capped or contaminated areas during construction:

- **Vanexco/Rod Mill Cap.** Materials excavated from the cap and from beneath the cap during construction of the administrative offices and railcar unloading facility would be segregated, characterized, and properly disposed of based on the characterization. Any material exceeding Ecology soil cleanup levels for unrestricted use (that cannot be used onsite) would be disposed of at a Subtitle D landfill in accordance with WAC 173-350. After construction of the foundation or pile driving, the cap would be restored with appropriate materials to form an impervious surface and to restore the integrity of the cap. The reconstruction of the cap would be conducted in accordance with applicable Ecology requirements, including review and approval by EFSEC and Ecology.

- **Shoreline Restrictive Covenant.** Materials excavated in this area for manhole relocation would be segregated, characterized, and properly disposed. Any material exceeding Ecology soil cleanup levels for unrestricted use (that cannot be used onsite) would be disposed of at a Subtitle D landfill in accordance with WAC 173-350. Clean soil would be used for backfill of the excavations.
- **Spent Pot Liner, North/North 2 Cap, or Ingot Plant Cap.** No site-specific measures to minimize disturbance of capped or contaminated areas would be required in these areas because the relocation of existing or construction of new rail infrastructure would not penetrate the existing cap in these areas.
- **Other Areas.** Excavation in other areas of the proposed Facility site would not be expected to encounter soils with contaminant concentrations greater than industrial cleanup levels and could be reused onsite in accordance with Port requirements. Excess excavated soils that would not be used onsite would be direct loaded or stockpiled; sampled and analyzed for PAHs, total petroleum hydrocarbons; and other parameters based on the anticipated contaminants, and disposed of offsite in an appropriate location based on the results of the analysis.
- **Groundwater.** Groundwater that is pumped out of the excavations would be stored, characterized, and treated in accordance with state and federal regulations prior to disposal. The water may be treated onsite and disposed of via the City's sanitary sewer system (if appropriate) or removed by a licensed commercial waste disposal facility for offsite treatment and disposal. If not exceeding state water quality levels, dewatering water would be managed in accordance with the proposed Facility's NPDES Construction Stormwater Permit requirements.
- **Stormwater.** Stormwater generated in construction areas with known soil contamination would likewise be collected, managed, treated, and disposed of in accordance with the proposed Facility's NPDES Construction Stormwater Permit.

A Contaminated Media Management Plan (Appendix D.8) describes management and disposal of contaminated media disturbed during construction to meet these requirements of existing environmental restrictive covenants. This plan lists the laboratory methods that would be used by an accredited analytical laboratory to analyze soil and water samples from areas with known or suspected contamination for contaminants of concern. Contaminated media would be collected, stored, and characterized to determine the appropriate disposal method(s). Excavated soils meeting the Port's fill acceptance criteria (Table 3 of Appendix D.8) would be reused on site. Contaminated soils would be transported by truck and stockpiled in a contaminated soil management area. The Contaminated Media Management Plan describes the measures that would be undertaken to prevent movement of contaminants of concern from the stockpiled material. Soil or groundwater disturbed outside of the areas subject to Ecology's environmental covenants but exhibiting any of the following characteristics would be designated as suspected of contaminated media: visible staining or unusual color, unusual odor, presence of black granular material, and/or presence of debris or visible sheen. In this case, should suspected contaminated media be encountered, work would be stopped; the Port, Vancouver Energy, and Ecology would be notified; the nature and extent of contamination would be documented; and handling, characterization, and disposal (or reuse) would be performed in accordance with the practices described in the Contaminated Media Management Plan.

Given the existing environmental covenants, Applicant-proposed BMPs, and the Contaminated Media Management Plan, impacts to onsite workers and the general public from releases of previously contaminated areas during construction of the proposed Facility are expected to be minor.

Hazardous Materials

Construction activities involving the use or generation of hazardous materials can cause releases to the environment as follows:

- **Accidental releases of materials used in construction.** Small volumes of fuels, paints, adhesives, lubricants, and solvents would be temporarily stored onsite. Releases of these materials can result from leaks and drips from their containment or their use. Larger releases can occur if containers suffer substantive failure or are accidentally tipped over. The impact of a release would be related to the location of the spill or release, the volume of the release, the media into which the hazardous material is released, and the ability to immediately contain the release and remove the released material.
- **Equipment fueling spills.** Construction equipment would need to be refueled, typically once or twice per day. While some equipment can be driven offsite for fueling, large equipment (e.g., excavators, dozers, cranes) would be fueled onsite using a mobile refueling service. A potential for a release during refueling exists.
- **Mobile equipment fluid leaks.** Construction equipment can leak oil or hydraulic fluid both during operations and during shutdown periods. Mobile equipment accidents at the site can also be a cause of fuel leaks. Refueling of smaller mobile equipment can cause leaks due to overtopping.
- **Inappropriate use of chemicals or material.** Use of chemicals or materials in a manner not originally intended by the manufacturer could result in the release of contaminants to the environment.
- **Inappropriate waste handling.** Construction activities would likely result in the generation of small quantities of solid waste, some of which may classify as hazardous. Inappropriate handling of waste materials could result in releases to the environment.

The risk of these causes of releases to the environment would be reduced by adherence to site-specific plans and BMPs, including the Applicant's construction SPCC Plan (Appendix D.1) and Contaminated Media Management Plan. The draft construction SPCC Plan addresses responsible personnel, spill reporting, Project and site information, preexisting contamination, potential spill sources, spill prevention and response training, spill report form(s), plan approval, and SPCC Plan acknowledgement forms (to be signed by all Project personnel).

BMPs include storing chemicals, fuels, and industrial gases used during construction in containers specifically designed for their individual characteristics. In accordance with the Port lease, the proposed Facility would not use, store, or handle chlorinated solvents onsite. Construction personnel working with hazardous chemicals would be trained in proper hazardous materials handling techniques and in emergency response procedures for chemical spills or accidental releases. PPE would be provided to employees and material safety datasheets (MSDSs) would be provided and maintained onsite. The OHSA Hazard Communication Standard (29 CFR 1910.1200[f]) requires that employers ensure employees know where the MSDSs are located so they can understand the hazards of chemicals to which they may be exposed.

The Contaminated Media Management Plan addresses management and disposal of contaminated soil and groundwater encountered in restricted areas of the site as well as any suspected contaminated soil or water during construction. Releases affecting public health are not anticipated during construction because of the limited types and relatively small quantities of hazardous materials that would be used during construction, and the prevention of public access to the construction site. These measures would reduce the harmful levels of exposure to hazardous materials, resulting in minor impacts to workers and the public during construction of the proposed Facility.

Site Security

To prevent public access to the proposed Facility site during construction, the Applicant would implement a Construction Site Security Plan to secure the site during construction. This plan would identify access procedures, roles, and responsibilities and methods of physically securing the site including measures for perimeter fencing, access gates, CCTV systems, and security personnel. The marine terminal (Area 400) would require construction personnel to comply with TWIC requirements. The Construction Site Security Plan would be developed in coordination with Port security personnel and would be submitted to EFSEC for review and approval prior to the beginning of construction. Adherence to the Construction Site Security Plan would protect workers and the public from threats and hazardous environments, resulting in minor impacts to environmental health during construction of the proposed Facility.

Operation

Occupational/Worker Safety

Occupational safety risks to Facility workers would be reduced through adherence to the Applicant's Operations Facility Safety Plan (Appendix D.12) and Operation Facility Oil Handling Manual. A Facility Security, Health, Environmental, and Quality manager would coordinate routine audits of key elements of the proposed Facility safety programs to assure they are being carried out as described. These audits would include formal and informal and include reviews of both operations activities and supporting documentation. Safety metrics would be tracked and reported including, but not limited to, hours worked, major incident assessments and high-potential incidents, injuries/illnesses, and near misses.

Although the Applicant has proposed numerous BMPs and safety measures to prevent accidents, a boiler or steam pipeline explosion at the boiler building (Area 600), at the storage area (Area 300), or in the unloading and office area (Area 200) where railcars are heated could occur. Facility workers could be at risk of injury or fatality. A boiler or steam pipeline explosion would not likely injure the public as such an event would be contained within Facility boundaries. The primary danger to workers would be from scalding water and steam and metal projectiles. Worker injuries could also include blunt force trauma from an explosion blast wind, crush injuries or penetrations of the body from expelled debris, or smoke inhalation, resulting in harm to the passages of the nose, airways, and lungs. Impacts to workers would depend on the presence of personnel in the immediate area at the time of the event. Evacuation procedures would be developed as part of the Operations Facility Safety Plan, which would reduce the potential for injury following a boiler or explosion event. Overall, environmental health impacts to workers from a boiler or steam pipeline explosion would be moderate to major, depending on the extent of the explosion and debris and if anyone is present in the event vicinity.

Facility workers involved in receiving unit trains on the proposed Facility rail loops and moving the trains through the railcar unloading area would be exposed to slow-moving rail traffic. In 2013, 706 railroad-related fatalities occurred in the United States. Less than 2 percent of fatalities occurred to railroad workers that were on duty, but just over half of the fatalities occurred on railyards to trespassers or off-duty employees (FRA 2015c). Trains on the proposed Facility loops would be under the continuous control of an engineer, travelling at maximum speeds of 10 mph. These slower speeds allow for improved traffic control; a lower risk of spill, fire, or explosion in the event of a derailment; and a reduced risk to workers in the area. Trains would be attended upon taking control of the unit train from BNSF and until the time control is released back to BNSF when the train leaves the Port property. Strict controls on the operation of trains under appropriate protocols to ensure operational safety would greatly reduce the potential for derailment and accidental release of hazardous materials. The Applicant's Operations

Facility Safety Program includes Operations Rail Operating Safety and Maintenance Plan procedures for working around traffic and active rail lines to make employees aware of safe working practices.

Adherence to operations manuals and safety and emergency plans would reduce hazard exposures to proposed Facility workers, so impacts to occupational health and safety would be minor. Public health and safety impacts are not anticipated due to the use of site security, which would prevent the general public from accessing the proposed Facility site.

Hazardous Materials

Inadvertent hazardous material releases can be caused by inappropriate equipment used to store and handle the materials; leakage or failure of storage and handling systems; inappropriate operation and maintenance of the storage and handling systems; human errors in operating and maintaining the Facility; external causes (e.g., uncontrollable natural events such as extreme weather or seismic activity, intentional destructive acts/vandalism) that could impact the integrity of storage and handling systems; and inappropriate handling of hazardous materials and wastes that may classify as hazardous.

During operations, each of the areas at the proposed Facility areas described below could experience inadvertent leaks of hazardous materials:

- **Rail Infrastructure.** Releases of crude oil from railcars could occur during the train arrival and staging process. However, the existing and proposed rail infrastructure at Terminal 5 has been designed to accommodate complete unit trains, thus avoiding the need for multiple switching movements during the unloading process, which could increase the risk of accidental derailment.
- **Unloading and Office Area** (Area 200). Releases could occur during the tank car unloading process from leaks at connections between the railcar and unloading hoses, the unloading hoses and piping, or the piping that captures the gravity-unloaded crude oil and conveys it to the transfer pipelines. Leakage or overfilling of the tank could lead to a release. Equipment maintenance activities occurring in this area would require storage of smaller amounts of cleaners, lubricants, and greases. Leaks or spills of these products could also cause a release. Spilled crude oil would flow into a containment collection system, which consists of continuous drip pans and collection piping that flows into surge tanks and is pumped into aboveground containment tanks that have a minimum capacity of 770 barrels (bbl).
- **Storage Area** (Area 300). Releases could occur from leaks at the crude oil storage tanks or from piping systems that transfer crude oil within this area. In addition, water treatment chemicals would be stored in the boiler buildings; leaks of the storage system could cause releases. Leakage or overfilling of the tank could lead to a release. Secondary containment consisting of a berm surrounding the tank would have total volume appropriate to 110 percent of the largest tank or 25 percent of all the tank volumes (whichever is the greater), plus an allowance for maximum daily rainfall and firewater retention. Releases could also occur if static electricity generated by crude oil moving in contact with other materials, including pipes, transfer pipelines, and storage tanks during crude oil conveyance resulted in ignition of the product. Water mist and steam generated during maintenance-related tank and equipment cleaning can also become electrically charged, in particular with the presence of chemical cleaning agents. The Applicant proposes to protect against potential ignition sources by (1) using proper grounding to avoid static electricity buildup and following formal procedures for the use and maintenance of grounding connections, (2) the use of intrinsically safe electrical installations and nonsparking tools, and (3) implementation of permit systems and formal procedures for conducting any hot work during maintenance activities.
- **Marine Terminal** (Area 400). Releases could occur from the vessel loading operations and the loading piping and hose systems. Secondary containment consisting of a fixed collection basin

and curbing surround the loading arm handling area, connections, and dock manifold to collect drainage drips and washdown. The material collected in the basin would drain to a 30-bbl sump tank located under the dock, equipped with a 100-gpm pump that operates automatically. The sump would also be equipped with an 80-gpm pump that could be started manually in the event that additional pumping capacity is needed. Leakage or overfilling of the tank could lead to a release.

- **Transfer Pipelines** (Area 500). Releases could occur from the piping and pumping systems that convey the crude oil from the unloading area to the storage area. Where underground, pipelines include secondary containment consisting of either double-walled pipe or casings around the pipeline.
- **Boiler Building** (Area 600. Crude oil would not be stored or handled in this area; however, water treatment chemicals would be stored in the West Boiler building, and leaks of the storage system could cause releases. Secondary containment is not provided for Area 600.

To reduce the potential for hazardous material releases, preoperational commissioning tests would be performed in accordance with industry standards and applicable regulations including, but not limited to, the following:

- Hydrostatic testing of piping systems, transfer pipelines, and storage tanks
- Testing and certification of the dock safety unit and MVCU in accordance with 33 CFR 154 Subpart E
- Testing of fire and alarm systems in accordance with applicable fire and building safety codes
- Constructing the storage tanks at the proposed Facility using a construction quality assurance/quality control program to ensure that no construction defects could result in a release

Engineering controls, materials testing, and emergency response plans developed for the proposed Facility would reduce the potential for hazardous material releases to impact the health and safety of workers during proposed Facility operation. During operation, occupational exposures could include skin contact with crude oil and inhalation of crude oil vapors during fuel loading and unloading. Worker exposure would be managed through the implementation of occupational health and safety management programs and measures applicable to hazardous materials management and chemical occupational health and safety hazards. Because exposure to hazardous materials during operation, if any, would be limited to relatively small quantities, and site security would prevent unauthorized public onsite, the impacts to workers or the public from exposures to hazardous materials would be minor. Impacts from exposure to hazardous materials related to crude oil spills at the proposed Facility are addressed in Section 4.6.

Site Security

The proposed Facility would implement an Operations Site Security Plan pursuant to 33 CFR 105. Security measures anticipated at the proposed Facility would include fencing to prevent any public access and security gating at the rail loop access at the Gateway overpass. Parking for the Facility's operations and maintenance staff would be provided at the administration and support buildings. All other persons, such as vendor equipment employees, maintenance contractors, and material suppliers, would have to acquire permission for access from a designated site employee prior to entrance. The plant manager would grant access to each Project area on a project/job need basis. Restricted access to the proposed Facility site would prevent acts of vandalism and would protect the general public from accidents that could occur onsite. It would be possible for the public to have access to a portion of the transfer pipelines but these areas would be monitored by Facility staff and electronic monitors.

Locations where oil handling and storage occur would be fenced by a 6-foot-tall chain-link fence with three strands of barbed wire above to prevent unauthorized entry. Fencing would be provided between the administration building and the rail infrastructure at Terminal 5, around the railcar unloading facility, and around the storage tanks. Access to the marine terminal would be through locked gates. All gates would be locked 24 hours a day, and no unattended public access to these areas would be permitted. All valves and pump controls would be enclosed within the locked security areas. Facility security fencing would protect outlet valves that could lead to an oil spill. Blind flanges and all valves that could direct the outward flow of the tank contents directly to the surface would be securely locked in the closed position. The operator would start pumps associated with railcar unloading, storage tanks, and vessel loading facilities through a secure terminal automation system at each location. All tank and pipeline connections, such as drains or vents, would be securely capped or blank-flanged when not in service or placed in standby service for extended periods of time.

The Facility would be staffed 24 hours per day, 7 days a week. Operations at the marine terminal would be staffed during vessel loading operations. Security placards and emergency contact names and 24-hour telephone numbers would be posted at the proposed Facility office. Facility security measures would be implemented in accordance with the Port's security program. Security cameras and lighting would be installed throughout the Facility to monitor facility premises involved in oil handling and storage. The proposed Facility would be equipped with low-level lighting around exits and general outdoor lighting for operating areas, roadways, fuel storage areas, and ship loading, railcar unloading, and parking areas. This lighting is provided for operator access and safety under regular operating conditions and would assist in the detection of leaks. Extra spot lighting would be provided around loading equipment maintenance areas and stairwells and catwalks and would assist in visual detection of oil leaks.

Adherence to the proposed Operations Site Security Plan, the installation of security fencing, lighting and surveillance, and the presence of employees and onsite security personnel would minimize the risk of breaches in site security, would lessen vandalism or thefts, and would protect the public from hazardous environments, resulting in minor impacts.

Decommissioning

Occupational/Worker Safety

Occupational safety risks to proposed Facility decommissioning workers would be managed through the application of safety and emergency plans. The Applicant would submit a detailed Site Restoration Plan within 90 days from the time EFSEC is notified of the Project's termination (WAC 463-72-040). The detailed Site Restoration Plan would identify, evaluate, and resolve environmental public health and safety concerns related to decommissioning. As part of this plan, the Applicant would identify in detail decommissioning activities and mitigation measures required to conduct these activities in a manner to protect the health and safety of workers, resulting in minor impacts to occupational/worker safety. The public would not have access to the Facility during decommissioning and would, therefore, not be directly exposed to decommissioning activities, resulting in negligible impacts.

Existing Site Contamination

In the event that decommissioning activities involve removal of proposed Facility foundations or concrete work that was constructed in locations with contaminated soils, these activities could inadvertently release contaminated material back into the environment, posing a health risk to workers. Decommissioning activities near capped areas would not be expected to breach the caps, but may temporarily disrupt surface water drainage patterns or otherwise impact ongoing/previous remediation activities. Prior to proposed Facility decommissioning, measures to manage previously contaminated areas would be included in the Site Restoration Plan. Environmental health impacts from existing site contamination would be minor because the Site Restoration Plan would identify, evaluate, and resolve environmental health concerns.

Soils and underlying groundwater would continue to be regularly monitored and regulated through Ecology.

Hazardous Materials

The impacts associated with harmful levels of exposure to hazardous materials during decommissioning would be similar to those described for construction of the proposed Facility. In addition, the disassembly of proposed Facility infrastructure without prior removal of residual hazardous materials could result in the release of contaminants to the environment. Prior to the decommissioning of systems, the former use of Facility components and their potential to contain residual crude oil would be considered to ensure that appropriate cleaning procedures are implemented prior to disassembly and removal. If equipment is proposed to be left onsite, it would be cleaned as appropriate to ensure residual hazardous materials are not left onsite potentially exposing future workers. Because exposure to hazardous materials during operation, if any, would be limited to relatively small quantities, and site security would prevent unauthorized public onsite, impacts to workers or the public from exposures to hazardous materials are anticipated to be minor.

Site Security

A Decommissioning Plan would be developed to guide the decommissioning process and include site security measures. Maintenance of site security during decommissioning would protect workers and the public from threats and hazardous environments, resulting in minor impacts to environmental health.

3.8.3.2 Rail Transportation

Accidents involving railroad employees along the rail corridor currently occur. In an ongoing effort to improve health and safety, the FRA's Office of Railroad Safety has 14 divisions that serve as technical experts on matters of railroad safety, provide technical assistance to field personnel, and aid in the development of regulations (FRA 2015d). Employees working within the BNSF right-of-way must undertake BNSF safety training including rail security awareness training and contractor orientation training. The additional rail traffic generated by the proposed Facility would represent a small fraction of the overall number of trains using the entire rail system.

Accidents and fatalities currently occur along rail corridors throughout the United States from trespassing and from at-grade crossing conflicts with pedestrians and motorists. From 1998 to 2013, 27 trespass fatalities occurred along the BNSF rail corridor from the Washington-Idaho border to the Port of Vancouver (UTC 2014), which equates to approximately 5.4 accidents per year. To reduce the number of pedestrian and motorist accidents, the FRA works in partnership with rail carriers, governments, and other organizations to sponsor, plan, and conduct educational outreach efforts at schools, workplaces, and other venues to raise awareness about the dangers and consequences of trespassing (FRA 2015a). Strategies and methods to prevent pedestrian and vehicular accidents, incidents, injuries, and fatalities at passenger stations or at-grade crossings include providing audible warning of approaching trains; using signs, signals, or other visual devices to warn of approaching trains; installing infrastructure at pedestrian and vehicular crossings to improve the safety of crossing railroad tracks; and installing fences to prohibit access to railroad tracks. Some at-grade crossings along the inbound rail route do not currently have some of these measures in place.

The Railway-Highway Crossings Program (23 USC 130) funds safety improvements to reduce the number of fatalities, injuries, and crashes at public at-grade crossings (FRA 2015c). The average number of trains per day on the proposed train routes to and from the proposed Facility is between 28 and 48 trains using each segment of track per day (Table 3.14-7). Annually, this daily average amounts to between approximately 10,220 and 17,520 trains per year. Considering that an average of 5.4 accidents per year occur on tracks with between 10,220 and 17,520 trains per year there is a very low frequency of accidents. The additional rail traffic generated by the proposed Facility would be approximately 1,460 trains per year, which would be a fraction of the overall number of trains using the system. Considering that the existing rate of accidents along the inbound rail route is extremely low, this small increase in trains is not expected to increase the rate of historical accidents and fatalities related to pedestrian trespass or motorists at most at-grade crossings along the rail corridor. However, as discussed previously, some at-grade crossings along the rail corridor may currently have elevated safety risks that would increase with additional train traffic. Therefore, impacts to environmental health from rail transportation are expected to be minor for most crossings but may be moderate for crossings with existing elevated safety risks. With further diagnostic review of the more vulnerable crossings, and with the addition of signage and other measures to reduce pedestrian and motorist accidents at at-grade crossings along the inbound rail route (see Section 3.8.5), the rate of accidents may decrease from current conditions.

3.8.3.3 Vessel Transportation

A vessel collision could have impacts to vessel crew and the public depending on the unique circumstances of the event and may include, but would not necessarily result in, injuries or fatalities. Impacts to other river users (e.g., fishermen, recreational boaters) could occur from collisions with vessel traffic associated with the proposed Facility, although all boats under 65 feet in length must yield to larger vessels and ships in all situations. On the Columbia River, smaller recreational vessels are advised to move to the shallower areas away from the middle of the ship channel to avoid collisions with larger vessels such as those associated with the proposed Facility (The Oregon State Marine Board 2007).

Historical collision data for the Columbia River analyzed in Appendix J estimate one vessel collision every 7.2 years involving a crude oil tanker (not necessarily resulting in a spill). This estimate projects approximately 2.8 accidents over the 20-year life of the proposed Facility. Impacts from such events would depend on the unique circumstance of the event and may include, but would not necessarily result in, injuries or fatalities which are considered to be moderate to major impacts. If a waterway is currently used near capacity, additional vessel traffic could increase the incidence of collision accidents among all of the vessels in the waterway (Appendix J). However, as the projected volume of vessel traffic in the Columbia River is below the historical high and substantially below the capacity of the navigation system, public health and safety impacts associated with vessels transiting to and from the proposed Facility are expected to be minor.

3.8.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to environmental health from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to environmental health beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. These facilities would likely involve construction of some sort, resulting in similar types of impacts to environmental health as the proposed Facility, including risks to personnel from working around heavy equipment, mobile equipment, water, and active rail lines; seasonal weather conditions, particularly the potential for hypothermia during cold weather or heat exhaustion/heat stroke during hot weather; exposure to previously contaminated sites or releases of hazardous materials; and exposure to electrical hazards, mechanical hazards, fall hazards, and noise hazards typical of a construction site. Environmental health impacts during

operations would depend on the type of facility developed at the site, but without knowing which commodity type or facility design, it is not possible to quantify impacts.

3.8.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to environmental health in this Draft EIS. The following draft plans prepared by the Applicant and submitted to EFSEC include design features and BMPs relevant to environmental health:

- **Health, Safety, Security, and Environmental (HSSE) Plan**[2] – provides an overview of relevant HSSE topics and their application to the construction and commissioning of the proposed Facility, describes training requirements for employees, safety committees and meetings, HSSE roles and responsibilities, site hazards, safety activities, PPE, and monitoring of HSSE performance to determine progress against objectives and targets and necessary management system changes.
- **Construction Site Security Plan**[2,3] – describes the security measures to be implemented during construction of the Facility including access procedures, roles, and responsibilities, and methods of physically securing the site including measures for perimeter fencing, access gates, CCTV systems, and security personnel.
- **Contaminated Media Management Plan**[2] **–** includes BMPs to manage all contaminated media encountered at the Facility site.
- **Construction Spill Prevention, Control, and Countermeasures Plan**[2] – describes prevention and response actions for oil, hazardous substance, and hazardous waste releases resulting from construction activities including inspections, training of employees in spill prevention and control, and containment and cleanup measures in the event of an accidental spill.
- **Construction Safety Plan** – would be developed prior to the start of construction by the construction contractor, would require compliance with all applicable laws, ordinances, regulations, and standards concerning health and safety, and would apply to the employees of the construction contractor and all subcontractors working at the proposed Facility location.
- **Construction Emergency Response Plan** – would be developed in coordination with local emergency responders prior to the start of construction by the construction contractor based on industry standards and regulatory requirements[4] and would cover actions employers and employees must take to ensure employee safety from fire and other emergencies.
- **Operations Site Security Plan**[5] – would be developed prior to the start of operations to describe security measures to prevent any public access to the proposed Facility.

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2 Draft version provided by the Applicant (Appendix D).

3 The Construction Site Security Plan is considered Security Sensitive Information (SSI) under 49 CFR 1520 and subject to protection from general release. As such, it is not included in Appendix D.

4 Including, but not limited to, WAC 296-24 (*Employee Emergency Plans and Fire Prevention Plans*), WAC 296-56 (*Safety Standards—Longshore, Stevedore and Waterfront Related Operations*), WAC 296-824 (*Emergency Response*), and 29 CFR 1910.38 (*Emergency Action Plan*).

5 Pursuant to 33 CFR 105.

- **Operations Facility Safety Plan** – would be developed prior to the start of operations to describe employee health and safety measures specific to the proposed Facility.
- **Site Restoration Plan**[6] – would be developed at least 90 days prior to the start of decommissioning to identify, evaluate, and resolve major environmental public health and safety issues related to decommissioning.

EFSEC recommends further discussions or a diagnostic review with BNSF, UTC, and affected local jurisdictions concerning crossings along the rail corridor within Spokane, Cheney, Lyle, Pasco, Mesa, Bingen, and White Salmon to determine if these crossings are protected at the appropriate level.

Appropriate measures should be implemented to prevent pedestrian and vehicular accidents, incidents, injuries, and fatalities at passenger stations or at-grade crossings along the inbound rail route in consultation with EFSEC. Such measures include installing signs, signals, or other visual devices to warn of approaching trains; installing infrastructure at pedestrian and vehicular crossings to improve the safety of crossing railroad tracks; potential closures of at-grade crossings and/or grade separation; and installing fences to prohibit access to railroad tracks.

3.8.6 Significant Unavoidable Impacts

In the unlikely event of a boiler or steam pipeline explosion, environmental health impacts to workers would be moderate to major in the event that persons are present in the event vicinity.

Impacts from a vessel accident (e.g., collision) would depend on the unique circumstance of the event and may include, but would not necessarily result in, injuries or fatalities which are considered to be moderate to major impacts.

6 Pursuant to WAC 463-72-040.

3.9 NOISE

This section addresses the noise and associated ground-borne vibration impacts on human sensitive receptors (such as residences, schools, or hospitals) during construction, operations, and decommissioning of the proposed Facility (direct impacts) as well as the noise and ground-borne vibration impacts from rail and vessel operations associated with the proposed Facility (indirect impacts). The sources and types of noise and vibration that could be associated with the proposed Facility are described. For better understanding of this subject, noise terminologies and descriptors are included below. A brief description of the methods used to assess noise and vibration impacts is included followed by a detailed analysis of increased noise and vibration levels from proposed Facility activities and associated rail and vessel transportation. Actions that could be taken to control excessive noise and vibration levels are also discussed. Noise impacts to terrestrial wildlife are addressed in Section 3.4 and noise impacts to aquatic species are discussed in Section 3.6.

3.9.1 Noise Terminology and Descriptors

Sound is mechanical energy transmitted by pressure waves in media such as air or water (FTA 2006). When sound becomes excessive, annoying, or unwanted, it is referred to as ***noise***. Noise may be continuous (constant noise with a steady decibel level), steady (constant noise with a fluctuating decibel level), impulsive (having a high peak of short duration), stationary (occurring from a fixed source), intermittent (at intervals of high and low sound levels), or transient (occurring at different rates). Noise and sound are used more or less synonymously in this report.

Sound pressure level (SPL) with respect to a particular source is measured in decibels (dB). The SPL measured by a sound level meter will vary with distance from the source and local acoustical conditions—that is, the farther from the source, the greater the reduction in sound pressure. Basic equations used in quantifying noise levels are included in Appendix K.

Decibel (dB) is a simplified unit of measurement used for sound pressure. The dB scale is a logarithmic rating system based on the squared ratio of the sound pressure being measured to a reference pressure (called "bel") multiplied by ten to get "*deci*bel." Mathematically, a decibel is defined as ten times the base 10 logarithm of the ratio between the two quantities of sound pressure (SPL)[1] squared, or: $SPL = 10\log_{10}(p/p_o)^2 = 20\log(p/p_o)$ dB; where p is the sound pressure being measured and p_o is the reference sound pressure. The reference sound pressure is standardized at 20 microPascals (µPa), which is the quietest sound that can be heard by most humans—the "absolute threshold of hearing." Thus, when the actual sound pressure is equal to the reference pressure, the resulting SPL is 0 dB; this does not, however, indicate an absence of any sound pressure (FTA 2006, Caltrans 2009).

Ambient noise at any one location includes all noise generated by typical sources such as traffic, neighboring businesses or industries, and weather (wind or rain). The ambient noise level is typically a mix of noise from natural and man-made sources that may be near or distant.

The ***A-Weighted Sound Level***, expressed as ***dBA***, can be used to quantify sound and its effect on people (EPA 1978). The A-weighted sound level is based on the dB unit, but puts more emphasis on frequencies in the range that humans hear best and less emphasis on frequencies that humans do not hear well, thus mimicking the human ear. Where the nature of the new sound is similar to the background sound (e.g., new traffic noise added to background traffic noise) an increase of 3 dBA is just noticeable, a change of

1 Sound pressures can be measured in units of microNewtons per square meter ($\mu N/m^2$), also called microPascals (µPa): 1 µPa is approximately one-hundred-billionth (1/100,000,000,000) of the normal atmospheric pressure.

5 dBA is clearly noticeable, and an increase of 10 dBA is perceived as doubling of the sound level. Where the nature of the new intruding sound is different from background sound (e.g., construction noise in an otherwise quiet setting), the new sound (e.g., sporadic "clanks" from construction equipment) can be perceived even if it only raises the overall noise level by less than 1 dBA. A person's perception of sound can be affected by other factors, such as the spatial distribution of the sound source, duration of the sound, the time pattern of the sound, and the time of day of the sound (Caltrans 2009). Table 3.9-1 contains examples of common activities and their associated noise levels in dBA (Caltrans 2009).

Table 3.9-1. Common Activities and Associated Noise Levels

Activity	Noise Level (dBA)
Loud live band music	110
Truck 50 feet away	80
Gas lawnmower 100 feet away	70
Normal conversation indoors	60
Moderate rainfall on vegetation	50
Refrigerator	40
Bedroom at night	25

Source: Caltrans 2009
dBA = A-weighted decibel(s)

Equivalent Sound Level (Leq). Leq represents time-varying A-weighted sound energy as a single value for a specific duration (EPA 1978). Thus, a value given in dBA is an instantaneous peak A-weighted sound value, but a value given in Leq reflects all of the varying A-weighted sound emitted over a specific time period. The Leq for a 24-hour period is shown as Leq(24) and the Leq for a 1-hour period is Leq(1). Leq can also be based on unweighted sound energy, so either the dB or dBA unit description should be presented along with the value.

Day-Night Sound Level (Ldn). Ldn is based on Leq(24), but takes into account the time of day of the occurrence of the sound as well as duration and level of the sound. Ldn is the A-weighted Leq for a 24-hour period with an additional 10-dBA weighting imposed on Leqs during the night (10 pm to 7 am). Table 3.9-2 shows examples of outdoor day-night noise levels (Ldn) (EPA 1978, Caswell and Jakus 1977).

Table 3.9-2. Examples of Outdoor Noise Levels

Outdoor Location	Noise Levels (L_{dn} in dBA)
Apartment next to freeway	87.5
¾ mile from touchdown at major airport	86.0
Downtown with some construction activity	78.5
Urban high-density apartment	78.0
Core commercial, Heavier industry	75.0
Heavier Industry	75.0
Urban row housing on major avenue	68.0
Lighter Industry	60.0

Table 3.9-2. Examples of Outdoor Noise Levels

Outdoor Location	Noise Levels (L_{dn} in dBA)
Old urban residential area	59.0
Wooded residential	51.0
Agricultural crop land	44.0
Rural residential	39.0
Open space (wetland, forest, open land, abandoned land)	35.0

Sources: Caswell and Jakus 1977, EPA 1978

dBA = A-weighted decibel(s), L_{dn} = day-night sound level, expressed in dBA

3.9.1.1 Vibration Terminology and Descriptors

Ground-borne vibration consists of oscillating motion within the ground. The effects of ground-borne vibration are typically no more than a nuisance; however, at extreme vibration levels buildings may be damaged. Ground-borne vibration can be felt outdoors, but it is typically more of an annoyance to people when they are indoors. The associated effects of a shaking building are more noticeable indoors, where people tend to be moving less and are, thus, more likely to perceive vibration. Induced ground-borne noise is an effect of ground-borne vibration and only occurs indoors, because it is produced from noise radiated from the motion of the walls and floors of a room or the rattling of windows or dishes on shelves. Table 3.9-3 shows common vibration sources and estimated vibration velocity levels in vibration velocity decibels (VdB) at relative distance from the source.

Table 3.9-3. Typical Levels of Ground-Borne Vibration

Vibration Source	Distance from the Source (feet)	Vibration Velocity Level (VdB)	PPV (in/sec)
Blasting on Construction Projects	50	100	NA
Bulldozers and Other Heavy Tracked Construction Equipment	50	93	NA
Commuter Rail	50	75 to 85	NA
Rapid Transit	50	70 to 80	NA
Bus or Truck over Bump	50	73	NA
Bus or Truck, Typical	50	63	NA
Background Vibration, Typical	50	52	NA
Pile Driver (impact type)	25	104-112	0.644-1.518
Pile Driver (sonic or vibratory type)	25	93-105	0.170-0.734
Large Bulldozer	25	87	0.089
Caisson drilling	25	87	0.089
Jackhammer	25	79	0.035
Loaded Trucks	25	86	0.076
Small Bulldozer	25	58	0.003

Source: FTA 2006 (Figure 7-3 and Table 12-2)

in/sec = inch(es) per second, NA = not available, PPV = peak particle velocity, VdB = vibration velocity decibel, referenced to 1 × 10-6 in/sec

3.9.2 Methods of Analysis

The potential for noise impacts can be assessed by considering the sound level increase over existing levels at noise-sensitive receptors, such as residences, schools, or hospitals. The study areas for the noise impacts analysis include:

- Noise receptors within approximately 3,000 feet of the proposed Facility site
- Noise receptors located adjacent to rail and vessel transportation routes within Washington

The sensitive receptors considered for this study and their respective distances from the Project's noise sources are described below and shown in Table 3.9-4 and on Figure 3.9-1.

The combined sound levels produced by noise sources and existing ambient sound levels were calculated using available noise modeling tools and noise equations. The Applicant conducted an initial noise study for the proposed Project. The list of typical construction equipment and corresponding noise levels, as shown in Table 3.9-5, was updated by EFSEC based on more current noise level data and according to typical stages of construction for an office or industrial structure. In addition, a discussion of ground vibration impacts on sensitive receptors has been included.

Existing ambient sound levels at the locations of sensitive receptors and Project noise sources were identified. Existing sound level data at the Port vicinity (see Table 3.9-4 and Figure 3.9-1) were compiled from measurements taken as part of previous noise studies in the vicinity (ambient noise surveys at three noise-sensitive receptors—the Tidewater office building, the Clark County JWC, and the Fruit Valley residential area—were conducted for *Port Of Vancouver USA Terminal 5 Development Noise Impact Assessment for Future BHP Billiton Operations Potash Facility* by Wilson Ihrig and Associates in 2011). Descriptions of existing noise levels along the rail and vessel corridors are described qualitatively (in Sections 3.9.3.2 and 3.9.3.3, respectively).

Construction noise sources were based on equipment used for a typical construction activity and equipment used for impact pile driving. The noise sources during construction and decommissioning would be similar, except that no impact pile driving would be used during decommissioning. The equipment list and corresponding typical noise levels provided by the Applicant were updated by EFSEC using more recent equipment noise level data obtained from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM)[2] Version 1.1 (FHWA 2006) and organized according to typical stages of construction for an office or industrial structure as provided in EPA's *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances* (EPA 1971).

Noise sources during operation of the proposed Facility include onsite terminal equipment operations and rail activities within the Project vicinity (Table 3.9-10). For construction and decommissioning activities, noise levels were calculated using basic noise equations (Caltrans 2009). For operations activities, the CadnaA noise model was used to estimate predicted sound levels of Facility operations and associated rail sound levels at nearby receptors. CadnaA is a sophisticated software program that enables noise modeling of complex industrial sources using sound propagation factors as adopted by International Standards Organization (ISO) 9613.[3] The modeling process included the following steps: (1) characterizing the noise sources, (2) creating three-dimensional maps of the site and vicinity to enable the model to evaluate effects of distance and topography on noise attenuation, and (3) assigning the equipment sound levels to appropriate onsite proposed Facility locations. The atmospheric absorption used for the CadnaA model

2 The RCNM is the FHWA's national model for the prediction of construction noise (FHWA 2006a).

3 ISO has established internationally recognized standard methods for calculating noise attenuation through the atmosphere.

was estimated for conditions of 50°F and 70 percent relative humidity (i.e., conditions that favor propagation). Topographic cross sections were constructed to calculate sound levels in the proposed Facility vicinity using CadnaA. The Federal Transit Administration (FTA)/FRA module available in CadnaA was used for modeling noise from trains; this module computes train noise using source levels and methods outlined by FRA.

The calculated noise levels resulting from proposed Facility activities were compared with existing ambient noise at sensitive receptor locations to quantitatively assess the level of noise impacts. Noise impact levels were analyzed by comparing quantitative results with noise thresholds established by the State of Washington and City of Vancouver, along with the EPA noise guidance for public health and welfare. The noise limits established in WAC Section 173-60 were used to compare the long-term noise impacts during operations and maintenance. However, for construction and decommissioning activities, the noise thresholds and restrictions established by the City of Vancouver were used for comparison because they are more stringent than the WAC.

FTA/FRA's noise impact criteria for combined noise increases (Figure 3.9-2) were used to provide a qualitative description of impacts from increases in ambient sound levels. FTA/FRA impacts are categorized as no impact, moderate impact, or major impact. The criteria are based on the land use category, Category 1 and Category 2, of the receiving properties. Category 1 land uses are tracts of land where quiet is an essential element in their intended purpose and include lands set aside for serenity and quiet, such land uses as outdoor amphitheaters and concert pavilions and National Historic Landmarks, where outdoor interpretation usually occurs. Category 2 land uses are residences and buildings where people normally sleep. For the proposed Facility, the receiving properties of concern are nearby residences and the JWC dormitories (identified as Category 2 on Figure 3.9-2). For Category 2 receiving properties, the FTA/FRA criteria includes consideration of the potential for sleep disturbance. Based on the FTA/FRA impact criteria, receiving locations with low existing sound levels can be exposed to greater increases in overall noise and locations with higher existing sound levels can be exposed to smaller increases in overall noise.

Noise impacts from rail transportation of crude oil within Washington were evaluated based on the assumption of four additional trains per day traveling the rail system, and noise impacts due to vessels transiting the Columbia River were evaluated qualitatively.

The American Correctional Association (ACA) Standards for Adult Correctional Institutions were considered for the noise impact analysis due to the JWC dormitories located just over 400 feet from the transfer pipeline area (Area 500). These standards apply to construction and operation of correctional facilities for accreditation purposes. Unlike state and local noise regulations, which are measured externally at the property line, the ACA standards are measured internally at the inside of the inmate housing facilities (Wilson Ihrig and Associates 2012, ACA 2013). Therefore, the ACA noise standards were not used for this noise analysis.

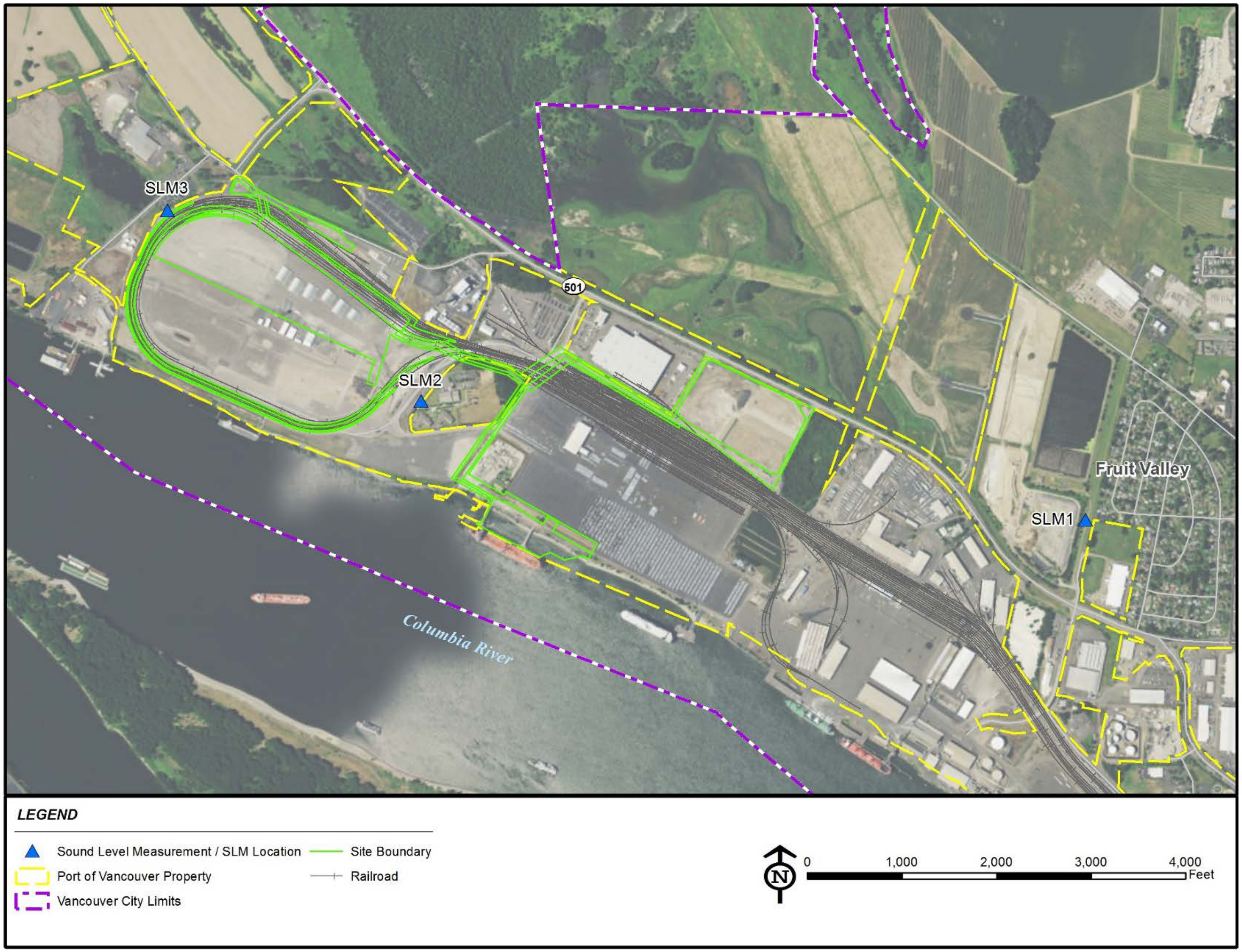

Figure 3.9-1. Sound Level Measurement Locations

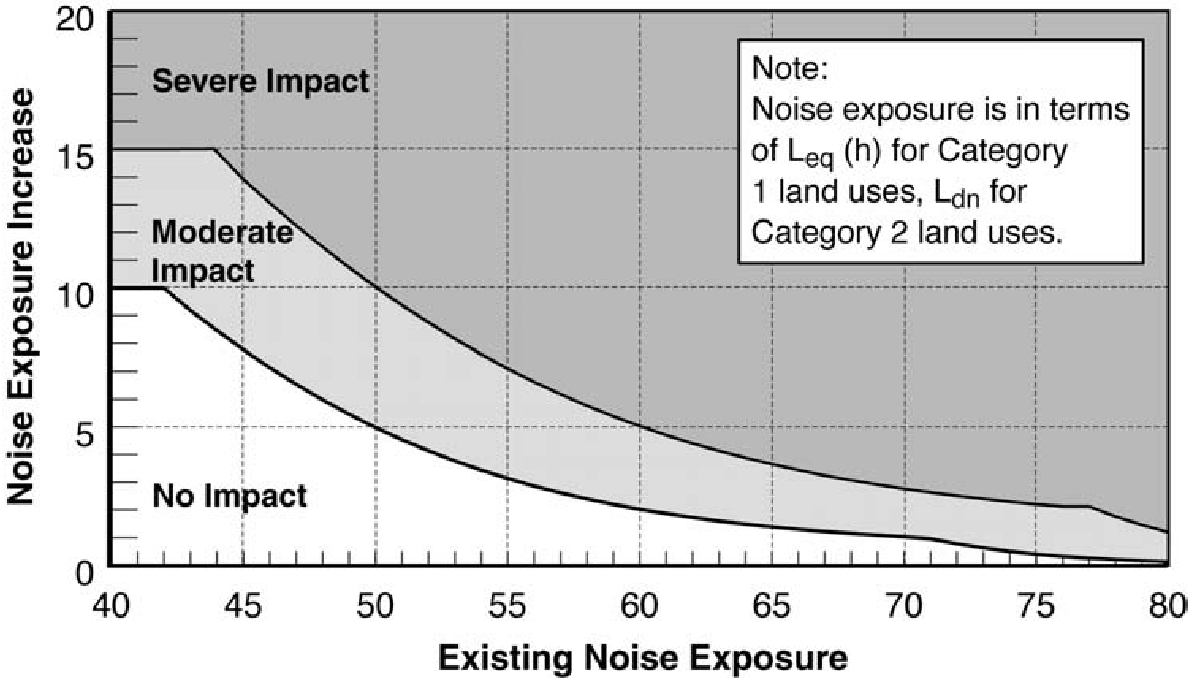

Figure 3.9-2. FTA/FRA Combined Noise Level Increases Impact Criteria

Source: FTA 2006 (Figure 3-2)

Leq(h) = equivalent sound level over a specific time (hour) period, Ldn = day-night sound level

3.9.2.1 Noise Receptors

Noise modeling used the following model "receptors" representing offsite receivers nearest the proposed Facility (Figure 3.9-3):

- R1 is the JWC's southwestern corner representing the western housing unit, which is nearest the rail infrastructure. The JWC's housing units are considered Class A (residential) environmental designations for noise abatement (EDNAs) when applying the WAC noise limits.
- R2 is the JWC's southeastern corner representing the eastern housing unit, which would be nearest the transfer pipelines and marine terminal. The housing unit is considered a Class A EDNA.
- R3 is the Tidewater office building near the northwestern corner of the proposed Facility. The office building is considered a Class B (commercial) EDNA.
- R4 is the CPU River Road generating facility north of the proposed Facility. This facility is a Class C (Industrial) EDNA.
- R5 is the nearest residential structure northwest of the proposed Facility, a Class A EDNA.
- R6 and R7 are residences in the Fruit Valley residential community east of the proposed Facility, both considered Class A EDNA.
- R8 is the nearest residence to the rail line in the Port's southeastern portion, a Class A EDNA near the intersection of W 20th Street and Thompson Avenue.
- R9 is the Subaru facility parking area, adjacent to the marine terminal. This facility is a Class C (Industrial) EDNA.

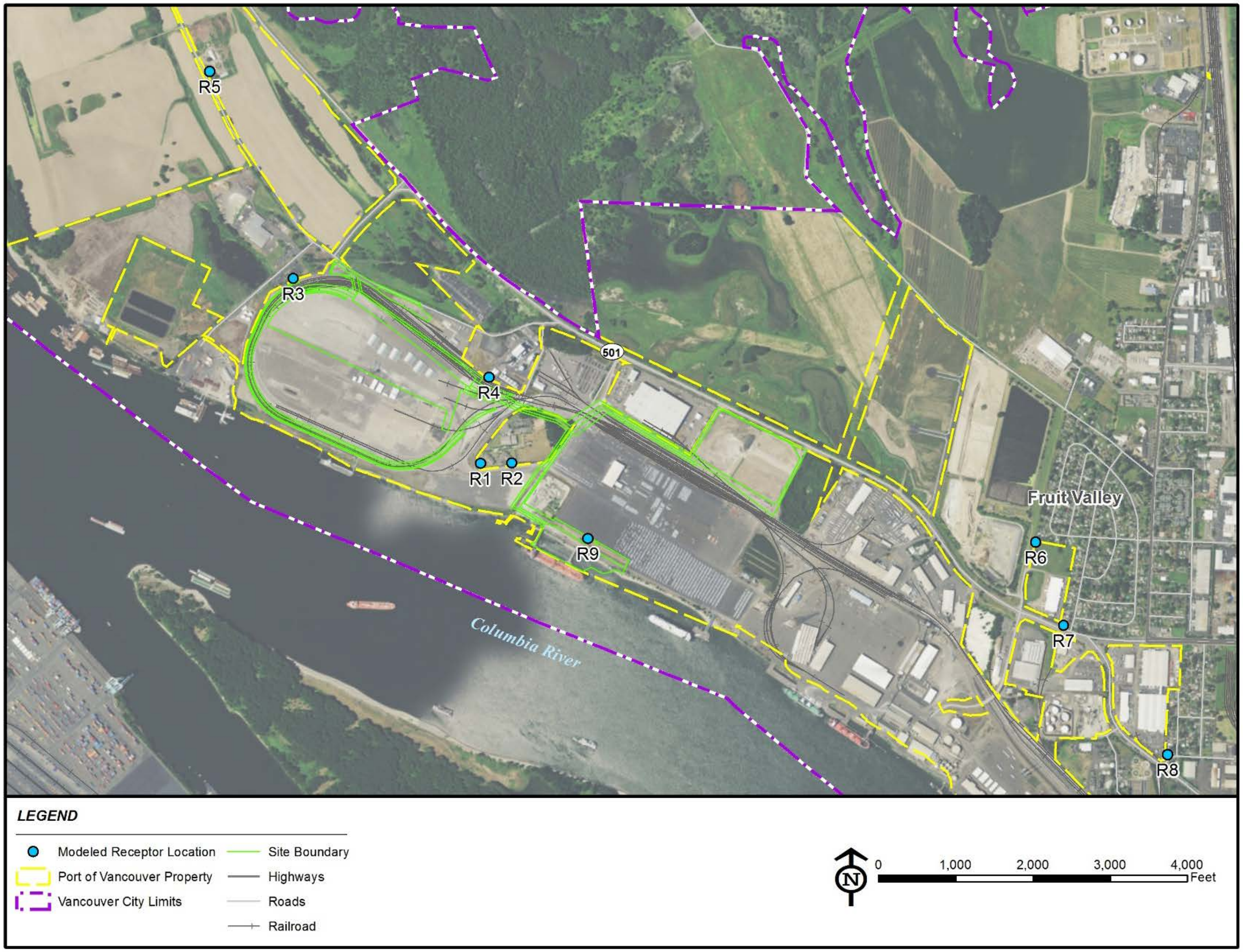

Figure 3.9-3. Noise Model Receptor Locations

3.9.2.2 Onsite Operational Equipment Noise Assessment

Operational noise at the proposed Facility would be generated by crude oil railcar unloading, storage, vessel loading, and transport. Some of these sources are relatively quiet and would not be audible when louder equipment is operating. The noise impact analysis focused on the louder noise sources, including pumps, compressors, blowers, the MVCU, and train sources. Equipment that would be located inside buildings (i.e., boilers and railcar unloading pumps) would not substantially contribute to overall proposed Facility noise, so inside equipment sources were not included in the noise analysis. Vessel noise is also relatively quiet in comparison to other sources and was not included in the analysis.

The noise impact assessment was based on the full operational configuration of the proposed Facility (i.e., capability to unload three unit trains at the same time) with all onsite equipment operating simultaneously and continuously. In addition to these onsite noise sources, trains would be arriving, unloading, and departing. Although noise from arriving and departing trains (while exempt from compliance with state and local noise limits per WAC 173-60-050; see Appendix A) were not included in the analysis, the noise levels from arriving and departing trains would not have an impact on the predicted noise levels onsite because they are expected to be less than the onsite train worst-case noise levels considered in the modeling analysis. In addition, noise from departing trains would diminish as they move farther away from the sensitive receptors onsite. Noise from trains operating onsite is not exempt and was included in the noise modeling analysis.

3.9.2.3 Onsite Operational Train Noise Assessment

The noise impact assessment for onsite train noise used the following information:

- An average of four trains would arrive at and depart from the proposed Facility during a 24-hour period, with arrivals and departures spread evenly over daytime and nighttime hours.
- Unit trains would be composed of three locomotives (two in the front, one in the rear) and would be approximately 7,800 feet in length.
- The physical limits for “onsite” rail operations are the site boundaries displayed in light green on Figure 3.9-1.
- Locomotives sound their horns at the at-grade crossing of the rail line and Thompson Avenue, on Port property east of Terminal 5. The nearest residences are located at the intersection of W 20th Street and Thompson Avenue, as represented by model receptor R8.
- Train travel during arrivals, departures, and onsite movements was assumed to occur at the onsite limit of 10 mph. However, because the actual speed would likely be less than the 10 mph allowed onsite, actual rail-related noise is expected to be somewhat less than modeled.
- Trains would pull onto the proposed Facility site, proceed to and stop at a location near the unloading area, and change operators.
- Trains would then proceed into a railcar unloading facility, where 30 cars would be unloaded, after which the train would move forward 30 car lengths (approximately 1,800 feet) and the next set of 30 railcars would be unloaded. The process would be repeated until the train was fully unloaded.
- The train would be inspected, any cars in disrepair would be removed, and the train would depart from the proposed Facility and Port.

- Locomotives would idle during the entire unloading process, which overestimates noise impacts. Under normal conditions, the three locomotives on each train would typically shut down most of the time, except during periods when the temperature is less than about 40°F.[4]
- A switch engine was assumed to operate on one of the short tracks (line 4109 or 4110) just east of the unloading facility. Two switch engines may be on the site, but only one switch engine would operate in the northern area of the site at any one time.
- One train would arrive from the mainline and traverse the Terminal 5 loop and one train would depart for the mainline in a 1-hour period to estimate worst-case hourly sound levels from unit trains along Port rail lines.

3.9.2.4 Ground Vibration Analysis

The perceptibility threshold of vibration is about 65 VdB, but human response to vibration does not usually occur until vibration exceeds 70 VdB, and most people are strongly annoyed by vibrations of 85 VdB in a residence (FTA 2006). Ground vibration calculation equations are included in Appendix K.

For the purposes of this study, the most stringent acceptable ground-borne vibration velocity levels (of 72 VdB for residential areas) and damage threshold (of 0.12 inch/second) for fragile buildings were used in evaluating ground vibration impacts. The vibration impacts analyses conservatively assumed the highest vibration level (of 112 VdB at 25 feet) for pile driving (see Table 3.9-3) in calculating vibration levels at sensitive receptors. Affected Environment

3.9.2.5 Proposed Facility

The proposed Facility site is currently zoned as Heavy Industrial (IH). The neighboring properties are also all zoned IH. These properties are considered Class C EDNAs (Industrial) when applying the Washington State noise limits shown in Appendix A, Table O-3.

The nearest sensitive receptors to the proposed Facility are the JWC dormitories, located just over 400 feet from the transfer pipeline area (Area 500) (Figure 2-1). Because the dormitories are used for sleeping, they are considered a Class A EDNA when applying the Washington State noise limits. Other sensitive receptors in the vicinity include residences in the Fruit Valley neighborhood located approximately 3,000 feet east of the storage tank area (Area 300) and a residential structure northwest of the proposed Facility located approximately 3,000 feet from the onsite rail infrastructure. All residential uses, regardless of zoning, are considered Class A EDNAs when applying the state noise limits. A multistory office building (Tidewater Terminal Company) is located just over 100 feet from the onsite rail infrastructure and has been included in the noise analysis. Although not specifically characterized as a sensitive receptor, the building is a Class B receiving property (i.e., commercial); however, tenants at the Tidewater office building could be affected by noise occurring at the proposed Facility.

The existing noise environment in the vicinity of the proposed Facility was previously characterized by sound level measurements (SLMs) taken on nearby parcels. These SLMs were taken with Type I sound level meters over a week-long period from March 25 to 31, 2011 (Wilson Ihrig & Associates 2011). Table 3.9-4 summarizes the SLMs and their locations are shown on Figure 3.9-1.

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4 The locomotives may be fitted with an Automatic Engine Shutoff System, which allows locomotives to shut down under programmable conditions that include ambient temperature. Automatic Engine Shutoff Systems are typically set up to shut down engines that have been idling for about 15 minutes.

- **SLM1.** SLMs were taken in the Fruit Valley residential area. Contributing noise sources included local and distant traffic, trains, and occasional aircraft. The SLMs are typical for many urban residential areas.
- **SLM2.** SLMs were taken on the JWC's western boundary. Low SLMs were detected because the adjacent industrial sites were unoccupied during the measurement period; however, they are lower than would be expected for a busy industrial area.
- **SLM3.** SLMs were captured on the property boundary of the Tidewater office building site on the western side of Terminal 5. The SLMs are representative of fairly remote locations, far from continuous noise sources, with occasional noise from trains passing by. Low SLMs were detected because the adjacent industrial site is currently unoccupied, however, they are lower than would be expected for a busy industrial area, except during the periods with nearby train activity.

Table 3.9-4. Sound Level Measurements in the Vicinity of the Proposed Facility and Distances to Nearest Sensitive Receptor

SLM Location	EDNA Classification	Daytime Leq (dBA)	Nighttime Leq (dBA)	Ldn (dBA)	Nearest Sensitive Receptor Distance* (feet)
SLM1, Fruit Valley Residential Area	Class A, Residential	52-64	46-63	61	3,000
SLM2, Jail Work Center	Class A, Residential	51-63	42-57	62	400
SLM3, Tidewater Office Building	Class B, Commercial	50-73	47-59	60	100

Source: Wilson Ihrig & Associates 2011

Note:

* Approximate distance of nearest sensitive receptor from the proposed Facility.

dBA = A-weighted decibel(s); EDNA = environmental designation for noise abatement (according to WAC; see Appendix A, Table O-3); Leq = equivalent sound level, expressed in dBA;, Ldn = day-night sound level, expressed in dBA

3.9.2.6 Rail Corridor

The proposed rail corridor through Washington would pass through land uses varying from densely urban to rural to undeveloped forested areas. Noise levels at sensitive receptors along the rail lines would vary corresponding to the types of land uses, with urban areas typically louder than undeveloped or rural areas. However, all land uses potentially affected by noise and vibration from unit trains associated with the proposed Facility are currently affected by existing rail noise and vibration, from locomotives, railcars, and locomotive or wayside horns (as required by federal regulations at at-grade rail crossings).

Similar to the affected environments within Washington, the example rail route from Williston, North Dakota, to Washington would pass through a multitude of land uses that affect existing noise levels and all land uses potentially affected by Project-associated rail noise and vibration are currently affected by existing rail noise and vibration, from locomotives, railcars, and locomotive or wayside horns at at-grade rail crossings.

3.9.2.7 Vessel Corridor

The vessel corridor is similarly variable as described for the rail corridor. Sensitive receptors adjacent to the vessel corridor are currently exposed to noise from vessels currently traveling through the Columbia River.

Outside Washington, primary sources of noise would be from wind, waves, and other vessels including large container ships. Sensitive receptors outside of Washington would primarily include receiving terminals where noise from existing vessels, industrial operations, and refinery operations would be expected to dominate the noise environment.

3.9.3 Impact Assessment

3.9.3.1 Proposed Facility

Construction

Noise from construction activities could add to the noise environment in the immediate vicinity. For the purposes of this analysis, construction activities are separated into typical construction activities and impact pile-driving activities.

Typical Construction Activities

In accordance with the FTA guidance on general assessment for noise impacts (FTA 2006), noise estimates are calculated based on the two loudest equipment units. Table 3.9-5 shows the two noisiest equipment types operating during each stage of a typical construction of industrial or office buildings (EPA 1971, FTA 2006). The highest combined equipment noise level at 50 feet occurs during the erection stage of construction at 89.6 dBA L_{MAX} (maximum Leq). Table 3.9-6 shows comparison of the resulting noise impact levels with the applicable noise limits and thresholds at sensitive receptors due to typical construction activities onsite. The estimated noise levels from construction at the nearest residences in the Fruit Valley residential area (more than 3,000 feet away) would be 52 dBA, which is less than the ambient noise level. The future ambient noise level[5] at the Fruit Valley residential area is 62 dBA, which would be an increase of 1 dBA, but there would be no noise impacts at the Fruit Valley residential area from construction activities at the proposed Facility.

As shown in Table 3.9-6, the calculated Project-related noise level at the JWC would be 70 dBA, which is above the noise limit of 60 dBA for residential receptor based on the daytime noise limit for Class A receiving property. The future ambient noise level at the JWC is 71 dBA, which would be an increase in 9 dBA. Although the FRA considers an increase in 9 dBA to be a major[6] noise impact, the existing ambient noise levels at the site are lower than would be expected for a busy industrial area, where the JWC is located. An ambient noise level of 71 dBA would be a typical ambient noise level for a heavy industrial area (typical noise levels at heavy industrial areas could go up to 75 dBA; see Table 3.9-2). Impacts to the JWC are therefore considered moderate.

The results of the noise calculations at the Tidewater office building show a worst-case noise level increase of approximately 22 dBA (Table 3.9-6). However, the majority of construction for the proposed Facility would occur in areas further away from the Tidewater office building, and noise emissions would be lower than the estimated noise levels presented in Table 3.9-6 due to the natural attenuation of sound with increasing distance. Nevertheless, noise impacts at the Tidewater office building are anticipated to be moderate to major and short term.

5 A logarithmic combination of Project-related and existing receptor ambient noise levels.

6 Noise impact level criteria are based on FTA/FRA combined noise level increases impact criteria shown on Figure 3.9-2.

Table 3.9-5. Noisiest Equipment Types and Noise Levels for Office/Industrial Building Construction

Construction Stage/Type of Equipment	Maximum Noise Levels, L_{MAX} (dBA) at 50 feet[a]
Ground Clearing	
Truck	76
Scrapers	84
Combined Equipment Noise Level[b]	*84.6 dBA L_{MAX}; 82.6 dBA Ldn*[c]
Excavation	
Rock Drill	81
Truck	76
Combined Equipment Noise Level[b]	*82.2 dBA L_{MAX}; 80.2 dBA Ldn*[c]
Foundations	
Jack Hammer	89
Concrete Mixer	79
Combined Equipment Noise Level[b]	*89.4 dBA L_{MAX}; 87.4 dBA Ldn*[c]
Erection	
Derrick Crane	81
Jack Hammer	89
Combined Equipment Noise Level[b]	*89.6 dBA L_{MAX}; 87.6 dBA Ldn*[c]
Finishing	
Rock Drill	81
Truck	76
Combined Equipment Noise Level[b]	*82.2 dBA L_{MAX}; 80.2 dBA Ldn*[c]

Sources: EPA 1971, FTA 2006, FHWA 2006

Notes:

a Noise levels are default values (or equivalent) from FHWA RCNM Version 1.1. Noise levels are LMAX based on actual measured noise level at 50 feet for each piece of equipment.

b Combined equipment noise levels based on two loudest types of equipment assumed to operate simultaneously, in accordance with the FTA guidance on general assessment for noise impacts (FTA 2006). Combined noise level is calculated using the following equation (Caltrans 2009):
$SPL_{Total} = 10Log_{10}[10^{SPL1/10} + 10^{SPL2/10} + \dots 10^{SPLn/10}]$, where: SPL_{Total} = total sound pressure level produced; SPL_1, SPL_2, and SPL_n represent the first, second, and n^{th} SPL, respectively

c For conservative assumption in Ldn conversion, L_{MAX} is used as average daytime hourly Leq for all 15 daytime hours, and 50 dBA (nighttime noise limit for City of Vancouver for Class C area noise source / Class A area receptor since no construction activities are to be conducted during nighttime) is used for nighttime hourly Leq for all 9 nighttime hours. (See Ldn and Leq definitions on i 3.9-2.)

dBA = A-weighted decibel, FHWA = Federal Highway Administration, FTA = Federal Transit Administration, Leq = equivalent sound level, expressed in dBA;, L_{MAX} = maximum Leq, L_{dn} = day-night sound level, RCNM = Roadway Construction Noise Model, SPL = sound pressure level

Table 3.9-6. Noise Levels and Impacts at Nearest Sensitive Receptors for Typical Construction Activities

Sensitive Receptor	EDNA Classification	Nearest Sensitive Receptor Distance[a] (feet)	Existing Ambient Noise Ldn[b] (dBA)	Project-Related Noise Level[c] (dBA)	Noise Limits (dBA)	Comply? (Y/N)	Future Ambient Level at Receptor[f] (dBA)	Noise Level Increase (dBA)	Noise Impact Level[fg]
Fruit Valley Residential Area	Class A, Residential	3,000	61	52	60[d]	Y	62	1	None
JWC Dormitories	Class A, Residential	400	62	70	60[d]	N	71	9	Severe
Tidewater Office Building	Class B, Commercial	100	60	82	65[e]	N	82	22	N/A[h]

Source: Wilson Ihrig & Associates 2011

Notes:

a Approximate distance of nearest sensitive receptor from the noise source.

b Existing ambient noise levels at sensitive receptors based on noise study conducted for another project located at the Port's Terminal 5 (Wilson Ihrig & Associates 2011).

c Project-related noise level means the estimated noise levels at receptor location resulting from logarithmic combination of noise generated by construction equipment but not including the receptor's existing ambient level. Noise level contributed by construction equipment is conservatively assumed at the highest level of combined equipment noise levels in Table 3.9-5 (i.e., 87.6 dBA Ldn for erection stage) prorated at receptors location using the following equation: $dBA_2 = dBA_1 + 20Log_{10}(D_1/D_2)$; where dBA_1 = noise level at a distance D_1 from the point source and dBA_2 = noise level at distance D_2 from the same point source.

d Noise limit for residential receptor is based on the daytime noise limit for Class A receiving property in Appendix A, Table A-3 since the City of Vancouver restricts construction activities, including construction staging, to between 7:00 am and 8:00 pm, 7 days a week.

e Noise limit for commercial receptor is based on the noise limit for Class B receiving property in Appendix A, Table A-3.

f Future ambient noise level at the receptor location is logarithmic combination of Project-related and existing receptor ambient noise levels.

g Noise impact level criteria are based on FTA/FRA combined noise level increases impact criteria shown on Figure 3.9-2.

h Noise impact level criteria do not apply to Tidewater office building, which is a commercial area. They apply only to Category 1 land uses where quiet is an essential element (such as outdoor amphitheaters, concert pavilions, and National Historic Landmarks) and Category 2 land uses (residences and buildings where people normally sleep).

dBA = A-weighted decibel (s), Ldn = day-night sound level, expressed in dBA, EDNA = environmental designation for noise abatement (according to WAC)

Y = Yes; N = No; N/A = Not Applicable

Impact Pile-Driving and Jet-Grouting Activities

The proposed Facility is expected to require impact pile driving during construction of upland dock structures, foundations of the rail unloading structure, and potentially at various locations along the pipeline. Jet grouting and a temporary grout batch plant (consisting of a cement silo, batch plant mixer, and high-pressure pumps) is proposed to be used for ground improvements at the marine terminal (Area 400).

Table 3.9-7 shows the estimated noise and vibration levels at sensitive receptors from impact pile-driving and jet-grouting activities. Note that impact pile driving and jet grouting would not be conducted simultaneously at any one location; therefore, predicted noise and vibration levels were calculated per activity and not combined.

Table 3.9-7. Noise and Vibration Levels During Construction for Impact Pile-Driving and Jet-Grouting Activities

Type of Equipment	Acoustical Usage Factor[a] (%)	Noise Levels, Ldn (dBA)			Vibration Velocity Level (VdB)			PPV (in/sec)		
		50 feet[b]	450 feet[c]	3,000 feet[c]	25 feet[d]	450 feet[e]	3,000 feet[e]	25 feet[d]	450 feet[f]	3,000 feet[f]
Pile Driver (Impact Type)	20	93	64	47	112	74	50	1.518	0.02	0.001
Jet Grouting	20	83	65 (combined)	63 (combined)	ND	ND	ND	ND	ND	ND
Concrete Batch Plant	15	81			N/A	N/A	N/A	N/A	N/A	N/A

Source: FHWA 2006, FTA 2006, WSDOT 2004

Notes:

a Acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factors are based on default values in FHWA RCNM. Assumed acoustical usage factor for jet grouting is the same as impact pile driver.

b Ldn Noise levels of 93 dBA, 83 dBA, and 81 dBA at 50 feet were calculated based on L_{MAX} of 95 dBA, 85 dBA, and 83 dBA, respectively. For conservative assumption in Ldn conversion, L_{MAX} is used as average daytime hourly Leq for all 15 daytime hours, and 60 dBA (nighttime noise limit for City of Vancouver Class C area) for nighttime hourly Leq for all 9 nighttime hours (i.e., construction is conducted only during daytime hours). (L_{MAX} noise levels for impact pile driver and concrete batch plant are default values from FHWA 2006; L_{MAX} noise level for jet grouting are from WSDOT 2004.)

c Prorated noise level calculations at sensitive receptors located 450 feet (JWC dormitories) and 3,000 feet (Fruit Valley residential area) assume a conservative shielding factor of 3 dBA and default acoustical usage factor of 20 percent for impact pile driver. Per the FHWA RCNM User's Guide, an assumed shielding factor of 3 dBA corresponds to a noise barrier or other obstruction (like a dirt mound) that barely breaks the line-of sight between the noise source and the receptor. These noise levels include Project-related noise and existing ambient noise at the sensitive receptor's location.

d Reference vibration level of 112 VdB and reference PPV of 1.518 in/sec for impact pile driver at 25 feet distance are as provided in FTA 2006 (see Table 3.9-3).

e Vibration velocity level at receptor's location was calculated using the equation: Lv(D) = Lv(Dref) – 30log(D/Dref) VdB, where Lv(D) is the vibration level at any distance, D, from a vibration source, and Lv(Dref) *(112 VdB)* is the measured vibration level at a reference distance, Dref *(25 feet)*, from the same vibration source.

f The PPV in in/sec at receptor's location is estimated using the following equation: PPVequip = PPVref x (25/D)1.5; where PPVequip is the peak particle velocity in in/sec of the equipment adjusted for distance, PPVref is the reference vibration level in in/sec (1.518 in/sec) at 25 feet from Table 3.9-3, and D is the distance from the equipment to the receptor.

dBA = A-weighted decibel(s), FHWA = Federal Highway Administration, in/sec = inch(es) per second, Leq = equivalent sound level, expressed in dBA, Ldn = day-night sound level, expressed in dBA, LMAX = maximum Leq, N/A = not applicable, ND = not determined, PPV = peak particle velocity, RCNM = Roadway Construction Noise Model, VdB = vibration decibel(s)

Table 3.9-8 shows a comparison of noise impact levels from impact pile driving and jet grouting with applicable noise limits and thresholds at sensitive receptors. Noise impacts would be negligible at the Fruit Valley residential area and moderate at the JWC dormitories.

Table 3.9-9 shows a comparison of vibration velocity impact levels from impact pile-driving activities with the acceptable ground vibration velocity levels at sensitive receptors.

Residents of the JWC housing units would experience lightly perceptible ground vibration during impact pile-driving activities at the Project site (Table 3.9-9). Although quantitative values for jet-grouting vibration levels have not been determined, vibrations are far less intense compared to those of an impact pile driver, resulting in negligible impacts. Vibration impacts due to impact pile-driving and jet-grouting activities would not be perceptible to the nearest sensitive receptor in the Fruit Valley residential area (Table 3.9-9).

Table 3.9-8. Impact Pile Driving and Jet Grouting Noise Levels at Nearest Sensitive Receptors

Sensitive Receptor	EDNA Classification	Nearest Sensitive Receptor Distance[a] (feet)	Existing Ambient Noise Level[b] (Ldn dBA)	Project-Related Noise Level[c] (Ldn dBA)	Noise Limits (dBA)	Comply? (Y/N)	Future Ambient Level at Receptor[e] (dBA)	Noise Level Increase (dBA)	Noise Impact Level[f]
Impact Pile Driver									
Fruit Valley Residential Area	Class A, Residential	3,000	61	57	60[d]	Y	63	2	None
JWC Dormitories	Class A, Residential	450[g]	62	65	60[d]	N	67	5	Moderate
Jet Grouting and Concrete Batch Plant									
Fruit Valley Residential Area	Class A, Residential	3,000	61	60	60[d]	Y	63	2	None
JWC Dormitories	Class A, Residential	450[g]	62	62	60[d]	N	65	3	Moderate

Source: FHWA 2006, FTA 2006

Notes:

a Approximate distance of nearest sensitive receptor from the noise source.

b Existing ambient noise level at sensitive receptors based on noise study conducted for another project located at the Port's Terminal 5 (Wilson Ihrig & Associates 2011). Note that measured existing ambient noise levels are already slightly above the acceptable noise limits of 60 dBA.

c Project-related noise level means the estimated noise levels at receptor location generated by construction activities but not including the receptor's existing ambient level. (See note 3 in Table 3.9-7).

d Noise limit for residential receptor is based on the daytime noise limit for Class A receiving property in Appendix A, TableA-3 since the City of Vancouver restricts construction activities, including construction staging, to between 7:00 am and 8:00 pm, 7 days a week.

e Future ambient noise level at the receptor location is logarithmic combination of Project-related and existing receptor ambient noise levels.

f Noise impact level criteria are based on FTA/FRA combined noise level increases impact criteria shown on Figure 3.9-2.

g Unlike the typical construction activities (JWC dormitories distance at 400 feet), the distance between the JWC dormitories and the closest impact pile-driving/jet-grouting activities (associated with the transfer pipelines) is 450 feet.

dBA = A-weighted decibel(s), EDNA = environmental designation for noise abatement (according to WAC), JWC = Clark County Jail Work Center, Leq = equivalent sound level, expressed in dBA, Ldn = day-night sound level, expressed in dBA

Y = Yes; N = No; N/A = not applicable

Table 3.9-9. Impact Pile-Driving Vibration Levels at Nearest Sensitive Receptors

Sensitive Receptor	Land Use Category	Nearest Sensitive Receptor Distance[a] (feet)	Vibration Velocity Level[b] (VdB)	Acceptable Vibration Velocity Level[c] (VdB)	Human Perception[d]	PPV (in/sec)[e]	Acceptable PPV[f] (in/sec)	Comply? (Y/N)
Fruit Valley Residential Area	Residential	3,000	50	72	Not perceptible	0.001	0.12	Y
JWC Dormitories[g]	Residential	450	74	72	Slightly perceptible	0.02	0.12	Y

Source: FHWA 2006, FTA 2006

Notes:

a Approximate distance of nearest sensitive receptor from the Project area.

b Vibration velocity level at receptor's location was calculated using the equation: Lv(D) = Lv(Dref) – 30log(D/Dref) VdB, where Lv(D) is the vibration level at any distance, D, from a vibration source, and Lv(Dref) *(112 VdB)* is the measured vibration level at a reference distance, Dref *(25 feet)*, from the same vibration source.

c Used the most stringent acceptable vibration velocity threshold for residential land uses (i.e., 72 VdB for frequent events - more than 70 vibration events of the same source per day).

d Qualitative description of vibration velocity levels with respect to human response to vibration (FTA 2006).

e The PPV in in/sec at receptor's location is estimated using the following equation: PPVequip = PPVref x $(25/D)^{1.5}$; where PPVequip is the peak particle velocity in in/sec of the equipment adjusted for distance, PPVref is the reference vibration level in in/sec *(1.518 in/sec)* at 25 feet from Table 3.9-3, and D is the distance from the equipment to the receptor.

f Used the most stringent acceptable ground-borne vibration threshold with respect to building damage (i.e., 0.12 in/sec for buildings that are extremely susceptible to vibration damage).

g Unlike the typical construction activities (JWC dormitories distance at 400 feet), the distance between the JWC and the closest impact pile-driving activities (associated with the transfer pipelines) is 450 feet.

in/sec = inch(es) per second, PPV = peak particle velocity, VdB = vibration decibels

Operation and Maintenance

Noise impacts during onsite operations were evaluated using the CadnaA Noise model. Major noise sources include the railcar unloading area (Area 200), storage tanks (Area 300), marine terminal (Area 400), and noise from train sources such as locomotives, railcars, idling locomotives, switch engines, and locomotive horns. Table 3.9-10 summarizes the SPLs associated with the dominant noise sources examined in this noise assessment.

Model-calculated A-weighted sound levels with the equipment identified above are presented in Table 3.9-11. The modeled levels include locomotives idling during train unloading, a single unit train movement during the unloading process, and noise from a switch engine, but do not include noise from offsite trains arriving or departing. As Table 3.9-11 shows, the model-calculated sound levels comply with the most restrictive nighttime noise limits at all sensitive receivers R1 through R9, and the modeled sound levels at the nearest residences to the proposed Facility are well below the nighttime noise limit. Operation-related noise levels at locations farther removed from the Facility would be even lower than the estimates in Table 3.9-11 due to the natural attenuation of sound with increasing distance.

In addition to considering compliance with the WAC noise limits, the potential for noise impacts from the proposed Facility was assessed based on increases to existing sound levels in the vicinity of the Facility and Port properties. This portion of the noise impact assessment considered all onsite noise sources identified in Table 3.9-10, trains traveling to and from the proposed Facility site on Port rail lines, and locomotive horns sounded near the at-grade crossing of the Port rail lines at Thompson Avenue. This review applied FTA/FRA modeling methodology and noise impact criteria (Figure 3.9-2). This method applies a 24-hour Ldn[7] for considering impacts due to noise increases at residential receivers. The FTA/FRA criteria compare sound levels created by operational noise from the proposed Facility to measured existing sound level to assess noise impacts. The FTA/FRA criteria only consider noise impacts at sensitive receivers (i.e., residences), so the Tidewater office building, CPU, and Subaru parking area were not included in this portion of the assessment.

Table 3.9-10. Summary of Major Facility Noise Sources and Associated Sound Pressure Levels at 100-Foot Distance

Source	Data Source	No. of Units	Approximate Sound Pressure Level at 100 feet (dBA)[a]
Railcar Unloading (Area 200)			
Compressor	A	1	40
Transformer	B	1	54
Storage Tanks (Area 300)			
Pumps	B	5	66
Transformer	B	1	54
Marine Terminal (Area 400)			
MVCU Blower	A	8	49
MVCU exhaust stack	A	8	36
Vapor blower staging unit blowers	B	2	60
Train Sources			
Locomotives (10 mph)	C	3	54 (hourly L_{eq})
Railcars (10 mph)	C	100–120 cars per train	52 (hourly L_{eq})
Idling locomotives	D	3	65
Switch engine	B	1[b]	66
Locomotive horn	C	1	81 (hourly L_{eq})

Sources:

A. Based on vendor-provided equipment sound levels (ICPE 2013).

B. Based on equipment sound levels from previous ENVIRON noise analyses.

C. DataKustik GmbH (2011), FTA 2006, FRA and Harris Miller Miller & Hanson 2006 (CREATE Noise Model).

D. Anderson (2009).

Notes:

a Engineering and equipment selection have not been finalized, so the above equipment sound levels are speculative and are used in this analysis to represent conservative estimates of sound levels from the proposed Facility.

b Although two switch engines may be onsite, only one switch engine will operate in the northern area of the site at any one time.

dBA = A-weighted decibel(s), Leq = equivalent sound level, expressed in dBA, MVCU = marine vapor combustion center

7 For purposes of calculating the Ldn from Facility activities, all onsite equipment was assumed to operate 24 hours a day, with 4 trains arriving and departing from the site over a 24-hour period spread evenly over daytime and nighttime hours.

Table 3.9-11. Model-Calculated Hourly Facility Sound Levels (Hourly Leq, dBA)

Receptor	Project Level[a]	EDNA	WAC Noise Limit[b, c]	Compliance with Noise Limit
R1 – SW Jail Work Center	45	Class A	50	Yes
R2 – SE Jail Work Center	38	Class A	50	Yes
R3 – Tidewater	52	Class B	65	Yes
R4 – CPU	61	Class C	70	Yes
R5 – NW Residence	27	Class A	50	Yes
R6 – Fruit Valley Residence	26	Class A	50	Yes
R7 – Fruit Valley Residence	25	Class A	50	Yes
R8 – SE Residence	23	Class A	50	Yes
R9 – Subaru Parking Area	70	Class C	70	Yes

Notes:

a The model-calculated sound levels are hourly Leqs. Although the actual noise limits are based on the hourly L25s, the onsite noise sources were assumed to operate continuously over an hour period, so the hourly Leq and L25 would be very similar. Therefore, the Leq can be used to estimate the potential L25 from onsite sources.

b The noise limits do not apply to offsite rail noise or onsite train delivery noise because surface carriers engaged in interstate commerce by railroad are exempt from the WAC noise limits (WAC 173-60-050).

c The limit shown for Class A EDNAs is for nighttime hours (i.e., 10:00 pm to 7:00 am). The daytime noise limit at Class A EDNAs is 10 dBA higher. However, because peak hourly operations could occur anytime day or night, the more stringent 50 dBA was used for considering potential compliance.

CPU = Clark Public Utilities, dBA = A-weighted decibel(s), EDNA = environmental designation for noise abatement (according to WAC), Leq = equivalent sound level, expressed in dBA, WAC = Washington Administrative Code

The calculated combined sound levels, sound level increases, and determinations of the potential for noise impacts based on FTA impact criteria are presented in Table 3.9-12. Operational noise from proposed Facility equipment and related rail activity would not result in FTA/FRA criteria major impacts to any sensitive receptors. Sound level increases at locations farther removed from these sensitive receptors would be lower due to the natural attenuation of sound with increasing distance. Noise impacts to sensitive receptors from operation of the proposed Facility are, thus, anticipated to be negligible to minor.

Table 3.9-12. Impacts to Sensitive Receptors from Facility and Rail-Related Increases over Existing Levels (dBA, Ldn)

Receptor	Measured Existing Level[a]	Facility and Rail-Related Level[b]	Overall Level[c]	Increase Over Existing	Severe Impact[d]	
R1 – SW Jail Work Center	62	53	62	0	5.5	No
R2 – SE Jail Work Center	62	47	62	0	4.5	No
R5 – NW Residence	60	36	60	0	5.0	No
R6 – Fruit Valley Residence	61	44	61	0	4.8	No
R7 – Fruit Valley Residence	61	48	61	0	4.8	No
R8 – Southeast Residence	61	56	62	1	4.8	No

Notes:

Apparent errors in math are due to rounding the numbers to the nearest whole number.

a The existing sound levels are determined from the measured Ldns displayed in Table 3.9-4.

b Project-related noise level calculated using CadnaA model.

c The overall level is the measured existing level added (logarithmically) to the Facility- and rail-related level.

d Noise impact level criteria are based on Federal Transit Administration (FTA)/Federal Railway Administration combined noise level increases impact criteria shown on Figure 3.9-2. Using FTA methodology and impact criteria, the major impact levels are identified based on the existing levels at each sensitive receiver. These major impact levels are then compared to the model-calculated Project levels to determine if the Project may result in a major impact.

Decommissioning

During decommissioning, noise levels similar to those identified during proposed Facility construction would be expected, except that no impact pile driving is anticipated. Therefore, noise impacts due to decommissioning of the proposed Facility would likely be similar to those identified for construction activities (no noise impacts at the Fruit Valley residential area, moderate noise impacts at the JWC, and moderate to major noise impacts at the Tidewater office building). Noise impacts at the JWC and the Tidewater office building would exceed regulatory limits, but would be short term.

In accordance with WAC 463-72-050, the Applicant would submit a detailed Site Restoration Plan within 90 days from the time EFSEC is notified of the Facility's termination. As part of this plan, the Applicant would identify in detail decommissioning activities and mitigation measures required to minimize impacts (including noise) and protect environmental health and safety.

3.9.3.2 Rail Transportation

Increases in rail traffic associated with the proposed Facility would result in increases in train-related noise and vibration at locations along the rail lines, both within and outside of Washington. Train-related noise sources may include moving locomotives and railcars, and at-grade crossing horns. Train-related vibration sources include moving locomotives and railcars.

Noise from at-grade crossing horns tend to be the loudest sources of train-related noise with the greatest potential for noise impacts. At-grade horns typically fall into two categories: locomotive-mounted horns and wayside horns. The primary difference in noise impacts from these two types of warning signals is the number of receptors potentially affected and the amount of time a receptor is exposed to the horn noise.

Federal regulations require sounding locomotive-mounted horns for 15 to 20 seconds prior to arrival at a crossing and emitting a sound level between 96 and 110 dBA at 100 feet (49 CFR 229.129 Subpart C – *Railroad Locomotive Safety Standards, Safety Requirements*). Because locomotive-mounted horns move with the train, nearby receptors are exposed to the loudest horn sound level only for a brief period of time. However, because the horns can sound for up to 0.25 mile prior to arriving at a crossing, the horn noise may affect numerous receptors near the rail line.

Similar to locomotive-mounted horns, federal regulations require that wayside horns also sound for 15 to 20 seconds prior to a train's arrival at a crossing and emit a sound level between 92 and 110 dBA at 100 feet (49 CFR 222 Appendix E – *Use of Locomotive Horns at Public Highway-Rail Grade Crossings, Requirements for Wayside Horns*). However, wayside horns are fixed and "aimed" at the oncoming traffic lanes, so they focus the warning signal noise directly towards the traffic approaching the rail crossing and, because wayside horns are installed at fixed locations and produce highly directional sounds, they reduce the area (and number of receptors) affected by horn noise. In contrast, any receptor located within the path of the wayside horn would be exposed to the loudest level for the full sounding period of 15 to 20 seconds. However, since numerous trains are already traveling on the rail mainlines, noise from trains is already affecting receptors nearest the rail line, regardless of whether the horn is fixed or moving.

An increase of four trains per day on average (four inbound trains and four outbound trains) anticipated to arrive and depart at the proposed Facility. To provide basis for noise impact assessment from increased rail volumes on statewide routes, rail volumes associated with the proposed Facility were compared to estimated 2020 rail volumes (BST 2011) assuming a high growth rate in rail traffic. For purposes of this analysis, the following assumptions were made: inbound fully loaded trains would use the Columbia River Alignment, empty outbound trains may use either the Columbia River Alignment or the Central Return - Stampede Pass Alignment, and all trains would be dispersed throughout the daytime hours

(7 am to 10 pm) and nighttime hours (10 pm to 7 am) in the same ratio as the estimated 2020 train volumes. Noise impacts were considered based on the calculated potential increase in Ldns along the various rail routes from trains associated with the proposed Facility in 2020. Table 3.9-13 shows the results of this analysis (BST 2011, BergerABAM 2014).

Table 3.9-13. Estimated Future Rail Noise in 2020 (Ldn)

Rail Segment	Estimated Train Volumes in 2020	Proposed Facility Trains	Total Trains in 2020	Percent Increase in Trains (%)	Estimated Sound Level Increase (Ldn dBA)
Columbia River Alignment					
Sandpoint, ID, to Spokane, WA	87	8	95	9	0
Spokane, WA, to Pasco, WA	71	4-8	75-79	6-11	0
Pasco, WA, to Vancouver, WA	57	4-8	51-65	7-14	0-1
Central Return - Stampede Pass Alignment					
Vancouver, WA, to Kalama/Longview, WA	83	0-4	83-87	0-5	0
Kalama/Longview, WA, to Tacoma, WA	79	0-4	79-83	0-5	0
Tacoma, WA, to Auburn, WA	99	0-4	99-103	0-4	0
Auburn, WA, to Pasco, WA via Stampede Pass	20	0-4	20-24	0-20	0-1

Source: BST 2011 (Table 5-1)

dBA = A-weighted decibel(s), Ldn = Day-night sound level, expressed in dBA

As shown in Table 3.9-13, trains associated with the proposed Facility would result in increases of 0 to 1 dBA in the Ldns at locations near proposed rail routes. Although an individual train passing by might be noticeable, the overall increases in Ldns are considered minimal, and no significant cumulative noise impacts would be expected. Noise impacts from trains associated with the proposed Facility are anticipated to be minor to receptors located along the rail lines.

Vibrations from rail traffic associated with the proposed Facility are expected to be similar to vibrations from standard freight trains already traveling on the rail line. According to FTA vibration impact criteria, a doubling of train events would be necessary to cause a significant vibration impact in a heavily used rail corridor (FTA 2006). Although the increase of four trains along the inbound rail corridor would produce vibration impacts, it would not represent a doubling of train events nor would it be expected to generate substantial noise impacts compared to the existing ambient noise levels. In addition, since numerous trains are already traveling on the rail mainlines, vibration from trains is already affecting receptors nearest the rail line. Existing vibration-sensitive uses (e.g., research facilities, recording studios) within 600 feet of the rail line and residences or other sleeping areas within 200 feet of the rail line may already be affected by train-related vibrations. Since only two trains can travel through the same area in the presence of double lines and for a very short period of time, the increase in railway traffic would not be expected to cause substantial vibration impacts. Vibration impacts from trains associated with the proposed Facility are, therefore, anticipated to be negligible to minor to receptors located along the rail lines.

3.9.3.3 Vessel Transportation

The proposed Facility would increase vessel trips in the Columbia River and along the Washington coast and could result in an increase in vessel-related noise (from vessel engines) at receptors within and near these shipping routes. The navigational channel proper is used by various types of personal, public, and commercial vessels, including vessels that transport commodities up and down the Columbia River. The width of the Columbia River varies throughout this reach from as much as approximately 6 miles near the mouth to 0.5 mile downstream of the proposed Facility. Recreational noise receptors[8] (e.g., motorized watercraft users) and commercial noise receptors[9] (e.g., freight ship operators) present on the Columbia River in the vicinity of vessel operations may perceive noise emissions during vessel passage, or may not in the event that the passing vessel noise is masked by the louder vessel being operated. In the case of nonmotorized watercraft users (e.g., kayakers, paddle-boarders), noise from vessels associated with the proposed Facility would be perceptible and would constitute a noise impact. However, since existing noise emissions from vessel traffic are already part of the noise background, impacts to noise receptors present within the Columbia River are considered to be minor.

Many types of land uses occur within 0.25 mile of the shoreline along the vessel corridor. Receptors with different types of sensitivity are associated with these land uses (e.g., transportation uses, including two- and four-lane highways and local roads; existing rail corridors; agricultural uses; industrial and light industrial uses; recreational uses; and residential uses). At any one location along the vessel corridor, therefore, noise resulting from a transiting vessel may or may not be perceptible depending on the receptor's sensitivity and other noise sources affecting the landscape. Since, existing noise emissions from vessel traffic are already part of the noise background, impacts to noise receptors along the shoreline of the Columbia River are considered to be minor.

The proposed Facility would increase vessel trips beyond the 3-nmi boundary and into the Pacific Ocean. However, the one vessel (two trips) per day associated with the proposed Facility is not likely to result in a noticeable increase in vessel-related noise at receivers near these shipping routes since these routes are typically offshore and away from shorelines, and numerous vessels already travel through these waters, resulting in negligible impacts outside of Washington state.

3.9.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following noise impacts from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional noise impacts beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. These facilities would likely involve construction of some sort, resulting in similar types of construction noise impacts as the proposed Facility including noise from construction equipment, the loudest of which are scrapers, jackhammers, derrick cranes, and rock drills (Table 3.9-5). In the event that impact pile driving is required for another facility constructed at the site, these sounds would likely be audible at and within the residences nearest this activity. Noise impacts during operations would depend on the type of facility developed at

8 Note that the "noise receptors" referred to in this case do not essentially qualify as "sensitive receptors" as defined in Section 3.9.1.

9 Note that the "noise receptors" referred to in this case do not essentially qualify as "sensitive receptors" as defined in Section 3.9.1.

the site, but without knowing which commodity type or facility design, it is not possible to quantify impacts.

3.9.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to noise in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce noise impacts to nearby sensitive receptors (FTA 2006):

- Develop and implement a Construction Communications Plan to inform the public and commercial operators of construction activities.
- Limit outdoor construction activity, including construction staging, to between 7:00 am and 8:00 pm, 7 days a week.
- House compressors and electric motors in metal-framed and -sided buildings with sound insulation designed into the wall thickness, as practicable.
- Construct noise barriers, such as temporary walls or piles of excavated material, between noisy activities and noise-sensitive receptors.
- Operate earth-moving equipment and site equipment on the construction lot as far away from vibration- and noise-sensitive sites as possible.
- Operate stationary construction equipment (e.g., air compressors, portable or backup generators) as far away from vibration- and noise-sensitive sites as possible.
- Combine noisy operations to occur over the same time period. The total noise level produced would not be substantially greater than the level produced if the operations were performed separately.
- Avoid use of an impact pile driver where possible in noise- and vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver are quieter and cause lower vibration levels where the geological conditions permit their use.
- Use specially quieted equipment such as quieted and enclosed air compressors and properly working mufflers on engines.
- Phase construction clearing, earth-moving, and ground-impacting operations so as not to occur in the same time period within the same vicinity. Unlike noise, the total vibration level produced could be substantially less when each vibration source operates separately.

In addition to these mitigation measures identified for the Applicant, the following measures have been identified to reduce noise impacts from train traffic:

- Establish quiet zones where conditions allow and close or replace at-grade crossings with grade-separated crossings to eliminate the need to sound horns to provide a warning of the approaching train. However, only the FRA can grant a quiet zone (BNSF 2015).
- Reconstruct at-grade crossings to provide a grade separation between rail and vehicular traffic to eliminate noise from horns. See Section 3.14.5 for a discussion on mitigation for at-grade crossings.

- Use wayside horns at the intersection instead of the louder locomotive horn to substantially reduce noise. A wayside horn causes less noise impact by focusing the warning sound only on the area where it is needed, such as near residential areas.
- Use ballast on a guideway to reduce train noise 3 dB at grade and up to 5 dB on aerial structures.
- Install effective barriers to break the line of sight between the noise source and the receiver. Barriers are most effective when they are closest to either the source or the receiver. If possible, acquire limited property rights for the construction of sound barriers at the receiver.
- Specify equipment for grade-crossing signals that sets the level of the warning signal lower where ambient noise is lower, that minimizes the signal duration, and that minimizes signal noise in the direction of noise-sensitive receivers.

3.9.6 Significant Unavoidable Adverse Impacts

Noise impacts at the Tidewater office building from construction and decommissioning of the proposed Facility are anticipated to be moderate to major and would exceed the regulatory limit for a commercial receiving property, but would be short term. Note, however, that commercial areas are not considered sensitive receptors for this study.

Noise impacts at the JWC from construction and decommissioning of proposed Facility elements are considered moderate but would be typical of a heavily industrialized area (as the JWC is located within an industrialized area classification). However, it would exceed the regulatory limit for a residential receptor, but would be short term.

3.10 LAND AND SHORELINE USE

This section describes existing and proposed land and shoreline use at and near the proposed Facility and along the rail and vessel routes. It also discusses the potential for adverse land use impacts to occur during construction, operation and maintenance, and decommissioning of the proposed Facility and during transportation of crude oil along the rail and vessel corridors. The relationship of the proposed Facility to relevant City of Vancouver land use plans, policies, and regulatory requirements is discussed along with EFSEC's authority to preempt state and local regulatory permits, requirements, and standards that would otherwise be applicable to the proposed Facility.

3.10.1 Methods of Analysis

The impact analysis for land and shoreline use focuses on the potential for construction, operation and maintenance, and decommissioning activities to result in immediate changes to existing land use (i.e., conversion from one type of land use to another) or longer-term changes over time to the existing or anticipated pattern of land use and development at the site, in the surrounding area, or along the rail and vessel transportation routes. Sources consulted included local and regional land use and zoning regulations, the City of Vancouver's Shoreline Master Plan, and the August 2014 EFSEC Order Determining Land Use Consistency. Existing land uses and zoning were identified and the potential for changes to them as a result of the proposed Facility were assessed. The impact analysis discusses the degree to which the proposed Facility would be consistent with relevant City of Vancouver land use plans, policies, and regulatory requirements and the compatibility of the proposed Facility to adjacent land uses.

The following study areas were used to assess land and shoreline use impacts from the proposed Facility:

- **Proposed Facility Site and Adjacent Parcels.** This study area includes the specific parcels at the Port directly affected by development of the Project elements described in Chapter 2 and those properties and land uses located immediately adjacent to those parcels. This study area includes land that would be most directly affected by construction, operation and maintenance, and decommissioning of the proposed Facility.
- **West Vancouver Area.** This study area includes an approximately 20-square-mile area surrounding the proposed Facility site extending from approximately Fort Vancouver on the east to Sauvie Island on the west and from Vancouver Lake on the north to Hayden Island on the south. This area could experience long-term changes to the existing or anticipated pattern of land use and development depending on how well the proposed Facility blends in with other current and future land uses in the area.
- **Rail Corridor.** The study area for the rail corridor includes land within a 0.5-mile buffer on either side of the rail line from Williston, North Dakota, to the Port. Impacts to land use along the rail corridor were analyzed qualitatively using available information on land use for the respective cities and states along the rail corridor. Land use within this area could experience long-term changes to the existing or anticipated pattern of land use and development depending on how compatible the transport of crude oil by train is with current and future land uses in the area.
- **Vessel Corridor.** The study area for the vessel corridor from the proposed Facility to the mouth of the Columbia River includes islands within the river channel and upland areas within 0.25 mile of the river's edge. Land use in this area could experience long-term changes to the existing or

anticipated pattern of land use and development depending on how compatible the transport of crude oil by vessel is with current and future land uses in the area.

3.10.2 Affected Environment

3.10.2.1 Proposed Facility

Land Use at the Proposed Facility Site

This section describes existing land use in the five main improvement areas comprising the proposed Facility site. These areas are shown together with the various Facility components on Figure 2-1 and are described in more detail in Chapter 2.

Unloading and Office Area (Area 200)

The unloading and office area is located on the Port's Terminal 5 property. Terminal 5 has been the location of intensive historic industrial uses dating back to the 1940s when the site was first developed for aluminum smelting operations. In the early 2000s, aluminum processing activities on the property ended, and the Port purchased the site in 2009. With the exception of the onsite water tower and the dock structure in the Columbia River, all structures associated with the aluminum-processing activities have been removed. The Terminal 5 site is currently developed for the outdoor storage of wind turbine components and other cargoes and contains a rail loop including multiple rail lines for Port operations. The rail on the Terminal 5 site represents the westernmost segment of the WVFA project.

Storage Area (Area 300)

The storage area (Area 300) is located on the southern side of NW Lower River Road just east of Farwest Steel (3703 NW Gateway Avenue). This site was first developed by the Port for industrial use beginning in the early 2000s and has been leased for short-term material storage.

Marine Terminal (Area 400)

The marine terminal (Area 400) consists of upland parking and material laydown area and Berths 13 and 14 on the Columbia River. These berths were developed by the Port in the early 1990s for short- and/or long-term moorage of oceangoing government and commercial vessels.

Transfer Pipelines (Area 500)

The transfer pipelines (Area 500) encompass the planned pipeline routes used for transferring crude oil between the Facility elements. The pipeline routes would be located primarily in existing rail and roadway corridors.

Boiler Building (Area 600)

The structure housing the boiler building would be located on the northwestern corner of Terminal 5. This area is currently a vacant gravel pad surrounded by access roads to Terminal 5. It was previously part of the former aluminum facility on Terminal 5 and was the location of an electrical transmission tower for powerlines.

Land Use Adjacent to the Proposed Facility Site

Other existing land uses located immediately adjacent to the proposed Facility site include a mixture of industrial and public uses:

- NGL Energy Partners LP is a propane distribution facility located just east of the unloading and office area (Area 200). The facility is located on an approximately 4-acre parcel consisting of railcar unloading, two 80,000-gallon propane storage tanks (with approval and supports for a third tank), truck loading racks, and a small office building. NGL Energy Partners acquired this site from Keyera in December 2013.

- Clark County JWC is located just east of the unloading and office area (Area 200) and north of the marine terminal (Area 400). The JWC is located on 18.3 acres and has 3 buildings. The in-custody and work release buildings are housing units with a total of 224 beds. The kitchen and warehouse building contains food and laundry service equipment and a jail industries warehouse.
- CPU River Road Generating Plant is located just east of the unloading and office area (Area 200). The CPU Generating Plant is a combined-cycle combustion natural gas turbine located on approximately 16 acres. The plant has the capacity to generate 248 megawatts of electricity.
- Tidewater Barge Lines and Tidewater is located just west of the site of the proposed boiler building (Area 600) and occupies approximately 23 acres, including an office building, liquid bulk storage tanks, and a marine terminal. The terminal handles containers and serves as a tug and barge maintenance and operations facility, including marine and upland facilities.
- Farwest Steel is located just west of the storage area (Area 300). Farwest Steel is a steel fabricator and distributor and occupies a 20-acre parcel, which was purchased from the Port in 2011. The site includes an office building and fabrication/warehouse building.
- Subaru of America automobile import facility is located adjacent to the marine terminal (Area 400). The Subaru Facility is a port of entry for automobiles and consists of a 70-acre parking and storage facility, a processing building, and facilities for railcar and truck loading.
- CalPortland Aggregate Yard is an 8-acre aggregate yard located west of the marine terminal (Area 400) where various sand and gravels are received by barge and truck, stored onsite, and shipped by truck.
- The Parcel 1A wetland is a 10-acre parcel located east of the proposed Facility previously enhanced by the Port for wetland impacts to other Port-owned properties (see Figure 3.10-1).
- Port Parcel 2 is used for wetland, habitat, and tree mitigation and a Bonneville Power Administration electrical substation. It is located north of the site of the proposed boiler building (Area 600) (see Figure 3.10-1).

Land Use in the West Vancouver Area

Land use in the area surrounding the proposed Facility site in the western portion of the City of Vancouver is predominantly industrial, agricultural, and open space (see Figure 3.10-1). The Port occupies more than 800 acres of developed industrial and marine property. More than 600 acres of Port-owned land is available for future industrial and marine development. The Port has about 610,000 square feet of dockside warehousing for general and bulk cargoes. In addition, the Port maintains 250 acres of open storage and marshalling yards adjacent to the Columbia River. Within the Port’s waterfront are 5 marine terminals with 13 shipping berths. The Port handles a broad range of cargos, including wind energy, break bulk, project and direct transfer cargoes, containers, automobiles, forest products, steel and aluminum products, liquid bulks, and a number of dry bulk commodities such as bauxite, mineral ores, concentrates, fertilizers, clays, grains, and bulk agricultural commodities (Port of Vancouver 2015).

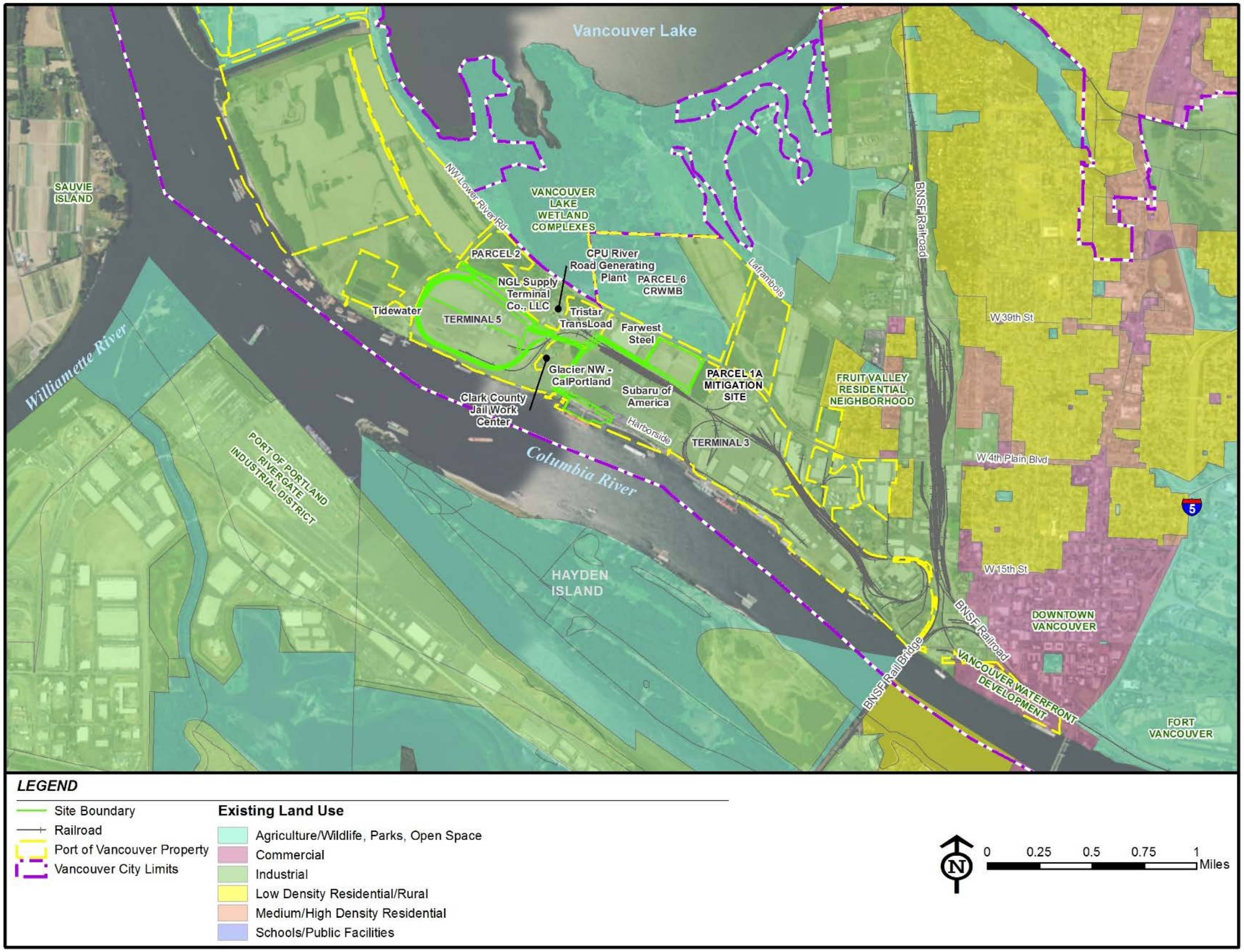

Figure 3.10-1. Land Use in the West Vancouver Area

Note: An enlarged version of this figure is available in Appendix P.11.

Existing land uses that are near the proposed Facility but not located on Port property include properties within the City of Vancouver; unincorporated Clark County, Washington; and Hayden Island in unincorporated Multnomah County, Oregon. These land uses include undeveloped publicly held parks and open-space properties in the Vancouver Lake Lowlands in the City and in Clark County. These properties are located north of the proposed Facility and on the northern side of NW Lower River Road from the Port. The CRWMB is a 154-acre mitigation bank located north of the storage area (Area 300) developed in partnership with the Port. It includes 78 acres of enhanced wetlands and 25.5 acres of created wetlands. To the south at the western end of Hayden Island is undeveloped land located within unincorporated Multnomah County.

Land use types beyond the nearby industrial properties at the Port include urban and rural residential, commercial, industrial (primarily along the Columbia River), and agricultural lands. Within Washington, the study area includes portions of the City and unincorporated areas of Clark County. The study area includes downtown Vancouver located southeast of the proposed Facility site, residential neighborhoods to the east and northeast, Vancouver Lake directly to the north, and agricultural lands to the north and northwest.

The closest residential area to the proposed Facility is the Fruit Valley neighborhood located about 3,200 feet (0.6 mile) east of the proposed storage area (Area 300). The Fruit Valley neighborhood contains approximately 1,000 residences in a mixture of single-family, duplex, and multifamily units. Other urban, suburban, and rural residential areas located within the study area include a variety of household types including single-family, multifamily, duplexes, and houseboats.

To the south and west, located across the Columbia River from the proposed Facility, are lands under the jurisdiction of both the City of Portland and Multnomah County, Oregon. These lands consist primarily of rural, agricultural, and developed urban use. Rural agricultural land use occurs on Sauvie Island west of the proposed Facility. Land use south of the proposed Facility across the Columbia River includes a combination of industrial, commercial, residential, and park lands.

Vancouver Waterfront Development Project

The Vancouver Waterfront Development Project is a mixed-use master-planned development currently under construction on a 32-acre site located between downtown Vancouver and the Columbia River. This project site is approximately 2 miles upriver from the proposed Facility (Figure 3.10-1). The development site is located adjacent to and south of the Port's main rail line providing access from the BNSF Fallbridge Subdivision into the Port.

Plans to develop a mixed-use residential and commercial project at the site were first evaluated as part of the City's *Vancouver City Center Vision & Subarea Plan* adopted in 2007. In October 2009, the City approved a Development Agreement with Columbia Waterfront LLC (Ordinance M-3700) and a Master Plan for the project was approved by the City in December 2009 (Ordinance M-3936). Construction began on an extension of three downtown Vancouver streets to the waterfront in 2014 and underground utilities (deepwater, sewer, stormwater lines) were installed along the waterfront in preparation of the extension.

The City is currently working on design and permitting for a 7.3-acre waterfront park that will be located along the shoreline at the development site, as well as securing additional funds to construct infrastructure within the development site, including the construction of roads, stormwater systems, and traffic signals (City of Vancouver 2014a). On April 6, 2015, the City Council unanimously voted to contract a consulting firm to develop final plans and specifications for the initial phase of the park (Fischer 2015). The City expects the park to be open by 2017.

The City has also completed the Vancouver Waterfront Access Project that involved the construction of two underpasses to reconnect downtown Vancouver to the proposed development site and the planned waterfront park (City of Vancouver 2014b). Completion of these two underpasses allows access to the site without requiring any at-grade railroad crossings.

The development agreement approved by the City provides for up to 3,300 residential units, 1 million square feet of commercial space, and a 160-room hotel (Vancouver Waterfront 2015). However, according to marketing materials, this project may be constructed to less density including a lower number of residential units and commercial/office space square footage (Real Estate Investment Group 2014). Infrastructure construction is currently underway and building construction is scheduled to begin in January 2016 with initial building completion by January 2017 (Vancouver Waterfront 2015).

Local Land Use Plans and Regulatory Requirements

As described in Chapter 1 of this Draft EIS, the proposed Project falls under EFSEC's jurisdiction and is subject to EFSEC's regulatory authority. State and local regulatory permits, requirements, and standards that would otherwise be applicable to the proposed Project – including land and shoreline use requirements – may be preempted pursuant to RCW 80.50.110 and RCW 80.50.120. If a Site Certification Agreement were to be issued for the proposed Project, it would take the place of any regulatory permit, certificate, plan, or similar approvals that would otherwise be required by a state or local government in Washington.

The City of Vancouver land use plans and regulatory requirements that would otherwise be applicable to the proposed Project are briefly described below to provide background for the discussion in Section 3.10.3 regarding the consistency of the proposed Facility with local land use plans and zoning ordinances.

City of Vancouver Comprehensive Plan

The City's Comprehensive Plan was first adopted in 1994 and since that time has undergone two major revisions (2004 and 2011). The intent of the Comprehensive Plan is to present a clear vision for Vancouver's future over a 20-year planning horizon. This plan established a vision of a livable urban area with growth tied to the ability to provide services and a range of residential options, including more intensive development in urban centers. The Comprehensive Plan forms the policy foundation for the legislative enactment of specific zoning ordinances (City of Vancouver 2011).

The proposed Facility would be located on land designated as Industrial by the City's Comprehensive Plan (Figure 3.10-2). The Industrial land use designation is intended to promote a variety of industrial uses ranging from light industry and office use to intensive industrial manufacturing, service, production, or storage often involving heavy truck, rail, or marine traffic. North of the proposed Facility across NW Lower River Road are areas designated Park/Open Space by both the City and Clark County.

Vancouver Municipal Code Title 20

VMC Title 20 Land Use and Development is the vehicle the City uses to implement the Comprehensive Plan (City of Vancouver 2004). It contains regulatory requirements to manage the community's growth in a manner that ensures efficient use of land, preserves natural resources, and encourages good design. VMC 20.130 established a zoning map that divides the City into different zoning districts that specify appropriate uses.

The proposed Facility would be located within a portion of the Port zoned IH (Heavy Industrial) (Figure 3.10-3). The purpose of the IH zone is to provide appropriate locations for intensive industrial uses, including industrial service, manufacturing and production, research and development, warehousing and freight movement, railroad yards, and waste-related and wholesale sales activities (VMC

20.440.020). Appropriate activities in the IH zone include those that involve the use of raw materials, require significant outdoor storage, and generate heavy truck and/or rail traffic.

Property located across SR 501 from the storage area (Area 300) include properties zoned Greenway by the City and Agricultural-Wildlife by Clark County. These areas are intended to preserve agricultural and wildlife use on land suited for agricultural production and to protect agricultural areas that are highly valuable seasonal wildlife habitat. The CRWMB located north of NW Lower River Road is zoned Greenway (Figure 3.10-3). The Greenway zone is intended to encourage the preservation of agricultural and wildlife use on land that is suited for agricultural production and is valuable for wildlife habitat (VMC 20.450.020(B)(2)).

Critical Areas

VMC Title 20 also includes regulatory requirements to protect ecologically sensitive and physically hazardous areas (critical areas), while also allowing for reasonable use of property (VMC 20.740). Protected critical areas include wetlands, fish and wildlife habitat conservation areas, geologically hazardous areas, and frequently flooded areas. Critical areas found on the proposed Facility site include fish and wildlife habitat conservation areas, frequently flooded areas, and geologic hazard areas (seismic hazards). Construction, operation, and decommissioning activities associated with the proposed Facility would occur, to some extent, in each of these areas.

Shoreline Master Program

The Washington State Legislature passed the Shoreline Management Act (SMA) (RCW 90.58) in 1971 and voters ratified the law in 1972. The SMA provides a statewide framework for managing, accessing, and protecting shorelines and applies to all marine waters, streams over 20 cfs mean annual flow, water areas and reservoirs 20 acres and greater, upland areas within 200 feet landward of these waters, all associated wetlands, and the lands lying under them. The SMA requires local governments (cities, towns, and counties) to adopt local plans and regulatory programs called Shoreline Master Programs (SMPs) to implement the SMA. The SMA emphasizes the appropriate use of shorelines for preferred uses, protection of shoreline resources, and public access. Each jurisdiction’s SMP acts as an “overlay zone” for the shoreline area.

The City’s current SMP was adopted in September 2012. In the Project vicinity, SMP jurisdiction extends from the middle of the Columbia River landward for a distance of 200 feet from the OHWM, including floodways and floodplains 200 feet from such floodways and all wetlands associated with the Columbia River (City of Vancouver 2012). The SMP designates the shoreline environment of the upland areas on the location of the proposed Facility as High Intensity and the areas below the OHWM of the river as Aquatic. The purpose of the “High Intensity” shoreline designation is to provide for high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing shoreline ecological functions and restoring ecological functions in areas that have been previously degraded. The purpose of the “Aquatic” shoreline designation is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the OHWM.

In addition, regulations in Section 5.8 of the City’s SMP address aesthetics and views of shoreline areas in Vancouver. These regulations promote maintenance of visual access to shoreline and avoidance of impacts to existing views of the water from adjacent property. Specific regulations pertain to buildings greater than 35 feet in height and prohibit the construction of buildings greater than 35 feet in height if they obstruct views of a substantial number of residences on adjoining lands.

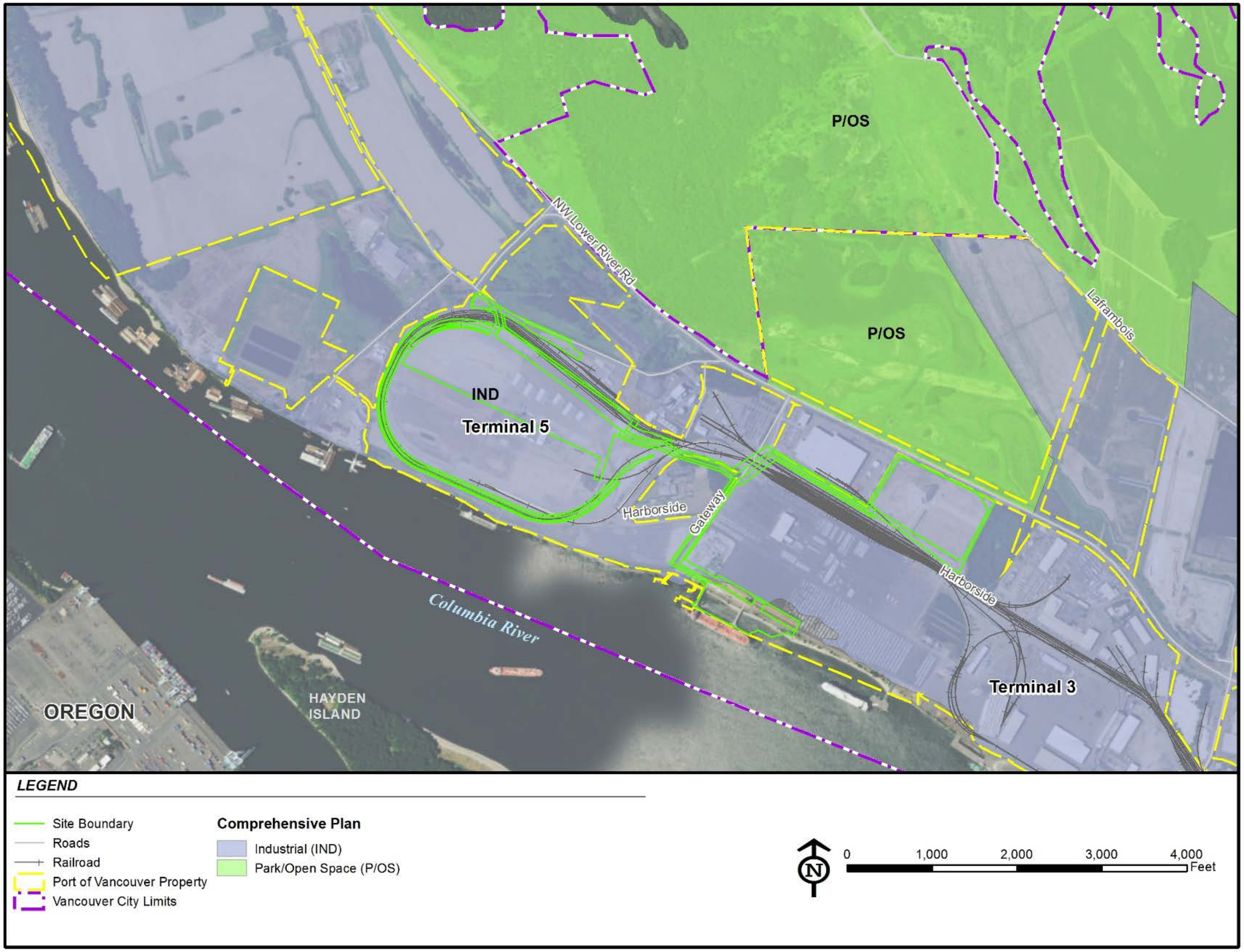

Figure 3.10-2. Comprehensive Plan Designations

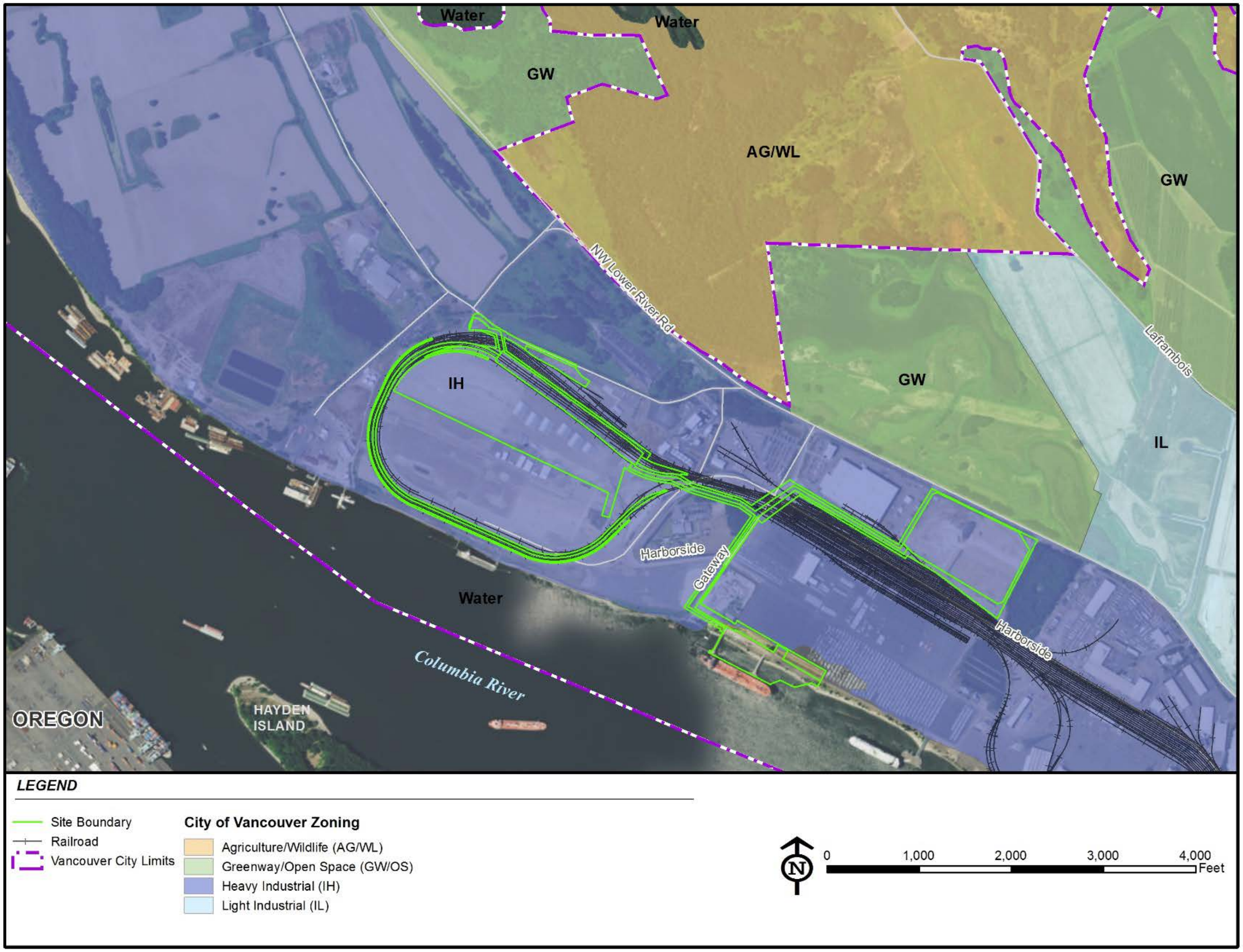

Figure 3.10-3. Zoning Designations

3.10.2.2 Rail Corridor

Table 3.10-1 lists the total number of acres by land use type within 0.5 mile of the rail corridor within Washington. Most of the land crossed by the rail corridor (42.9 percent) is agricultural land, forested timber land, or open space. The next largest category is open water (20.5 percent), which reflects the fact that the rail corridor runs parallel to the Columbia River at varying distances (from immediately adjacent to over a mile from) for approximately 225 miles between Kennewick and the Port of Vancouver.

Major population centers located along the rail corridor in Washington include Spokane, Cheney, Tri-Cities (Pasco, Richland, and Kennewick), and Vancouver/Camas/Washougal. Notable land uses crossed by the rail corridor along the Columbia River include Umatilla, Pierce, Franz Lake, and Steigerwald national wildlife refuges (NWRs) and Columbia River Gorge National Scenic Area, which includes large portions of Gifford Pinchot National Forest (see Appendix P.5, Mapbook K7A, Sheets 5 through 9).

Table 3.10-1. Land Use along the Rail Corridor in Washington

Land Use	Acres Within 0.5 Mile	Percent
Agriculture	10,939	4.4
Agriculture/timber/open space	106,459	42.9
Commercial	5,429	2.2
Community facilities	1,785	0.7
Forest	1,515	0.6
Industrial	1,252	0.5
Mining activities	376	0.2
Open water	50,913	20.5
Recreation	4,109	1.7
Residential	21,784	8.8
Transportation / communication / utilities	23,600	9.5
Undeveloped	19,894	8.0
Total	248,055	100

The majority of the rail corridor passes through forest, agricultural, and range land in Idaho, Montana, and North Dakota. Cities and towns with populations greater than 10,000 located along the rail corridor outside of Washington include Kalispell, Montana, and Williston, North Dakota. Notable land uses crossed or adjacent to the rail corridor in Montana include Fort Peck and Blackfeet Indian reservations, Glacier National Park, Great Bear Wilderness Area, and Flathead and Kootenai national forests (see Appendix P.5, Mapbook K7B, Sheets 1 through 5).

3.10.2.3 Vessel Corridor

Land uses along the Columbia River from the proposed Facility to its mouth are primarily rural with agriculture, forestry, and open space making up the largest area. Table 3.10-2 lists the total number of acres by land use type within 0.25 mile of the vessel corridor in both Washington and Oregon. The majority of the vessel route passes through nonurbanized areas of shrub- and grasslands, forest, and agriculture (see Appendix P.5, Mapbook K7C, Sheets 1 through 7).

Incorporated cities and towns along the Washington side of the Columbia River include Vancouver, Kalama, Longview, Cathlamet, and Ilwaco. Cities and towns on the Oregon side of the Columbia River include Portland, St. Helens, Rainier, Astoria, and Warrenton (Table 3.10-3). Notable land uses along the vessel corridor include the Ridgefield, Julia Butler Hansen, and Lewis and Clark NWRs and Fort Columbia and Cape Disappointment state parks (see Appendix P.5, Mapbook K7C, Sheets 5 through 7).

Table 3.10-2. Land Use along the Vessel Corridor

Land Use	Acreage within 0.25 mile of Columbia River	Percent
Agriculture	14,164	19.4
Urban	4,578	6.3
Forest	24,865	34.1
Shrub- and grasslands	29,076	40.0
Undeveloped/open space	163	0.2
Total	72,846	100

Table 3.10-3. Incorporated Cities and Towns along the Vessel Corridor

Cities/Towns	Population (2010)
Vancouver, WA	161,791
Kalama, WA	2,344
Longview, WA	36,648
Cathlamet, WA	532
Ilwaco, WA	936
Portland, OR	583,776
St. Helens, OR	12,883
Rainier, OR	1,895
Astoria, OR	9,477
Warrenton, OR	4,989

Sources: Washington State Office of Financial Management 2014, Portland State University 2014

3.10.3 Impact Assessment

The evaluation of impacts to existing land uses assesses the potential for the proposed Facility to convert existing land uses to different uses or to cause a notable change to existing patterns of land use activities or development. Impacts to land use along the rail and vessel corridors are assessed based on available information on ownership and land use along the corridors.

3.10.3.1 Proposed Facility

Construction

During construction, the potential exists for construction-related traffic and noise to result in some temporary disturbance to nearby businesses and public facilities (JWC) in the immediate Project vicinity. These impacts would be minor compared to the nature of existing noise and traffic associated with current Port operations and would not be expected to cause any change to existing land use or development. In addition, most of the site has already been prepared for future development. For example, structures previously on the site have been removed, areas with contaminated soils have been remediated, most of the site has been graded and graveled, and much of the needed rail infrastructure has been installed. The overall impact to land and shoreline use from construction of the proposed Facility would be minor.

Operation and Maintenance

Because the proposed Facility site would be developed on land currently designated for industrial activities and Facility operations and maintenance activities would be similar to other industrial activities already occurring at the Port, the proposed Facility would not be expected to alter existing land uses, activities, or development patterns within the Port or in the West Vancouver area. The proposed Facility would not require any conversion of existing or planned land uses as identified by local land use plans. No operational or maintenance-related impacts to land uses are anticipated and the overall impact to land and shoreline use from operation and maintenance of the proposed Facility would be minor. Other impacts to existing or proposed land use near the proposed Facility or in the West Vancouver study area (i.e., noise, air quality, environmental health) are not anticipated to occur at levels that would result in a change in land use or future development patterns. Impact to the JWC, adjacent office buildings, and nearby residential areas (i.e., the Fruit Valley Neighborhood) are discussed in other sections of Chapter 3 in this Draft EIS.

Decommissioning

Decommissioning would occur upon expiration or termination of the lease of the land held with the Port and could include removal of the buildings, storage tanks, and piping system associated with the proposed Facility. The impacts resulting from decommissioning activities would be similar in nature to the impacts of construction due to the types of equipment that would be used and the duration of the activities and would be minor compared to the nature of current Port operations. If the Project were constructed and operated pursuant to a site certification agreement with EFSEC, the Applicant would be required to prepare a detailed site restoration plan that addresses the decommissioning activities, identifies any impacts that might result from the decommissioning activities, and includes appropriate mitigation measures to protect the environment and the public against risks and dangers resulting from site operations and activities (WAC 463-72). The overall impact to land and shoreline use from decommissioning of the proposed Facility would be minor.

EFSEC Land Use Consistency Determination

RCW 80.50.090(2) requires EFSEC to conduct a public hearing to determine whether the proposed site (as opposed to the Facility's construction and operational conditions) is consistent and in compliance with certain city, county, or regional land use plans or zoning ordinances. EFSEC's procedures for doing so are at WAC 463.26. In May 2014, EFSEC conducted the land use consistency hearing for this project and in August 2014 issued its Order Determining Land Use Consistency.

EFSEC's Order concluded that the site is consistent and in compliance with the portions of the City of Vancouver's Comprehensive Plan and zoning ordinances that meet the narrow statutory definitions of the terms "land use plan" and "zoning ordinances" in RCW 80.50.020—that is, the site is consistent with the City's land use map and the associated definitions in the Comprehensive Plan and the site is in compliance with the City's zoning map, development restrictions, and associated definitions in the City's zoning ordinances. The portions of the City's Comprehensive Plan and zoning ordinances that do not meet these narrow statutory definitions were outside of the scope of EFSEC's land use consistency analysis. EFSEC noted that the Comprehensive Plan designates the area "Industrial" and allows within it the "IH Heavy Industrial" subtype, which is generally intended for intensive industrial manufacturing, service, production, or storage often involving heavy truck, rail or marine traffic, outdoor storage, and activities generating vibration, noise, and odors. EFSEC also noted that the City's zoning ordinance designates the area "IH-Heavy Industrial," which is a designation appropriate for intensive industrial uses such as warehousing, freight movement, and railroad yards, including the use of raw materials, significant outdoor storage, and heavy rail traffic. EFSEC concluded the proposed Facility would be permitted outright in the IH zone and would meet the associated development standards for the IH zone.[1]

EFSEC did not, however, address matters outside of the narrow scope of an RCW 80.50.090(2) land use hearing and did not opine on the degree to which the construction and operations of the Facility would comply with any pertinent—but nonbinding—provisions of the City's Comprehensive Plan or zoning ordinances. For the purposes of SEPA review, this Draft EIS includes the following discussion regarding the consistency of the proposed Facility with the regulatory requirements of the City's Critical Areas ordinance and SMP.

Consistency with City of Vancouver Critical Areas Ordinance

Project activities at Berths 13 and 14 in the marine terminal (Area 400) including proposed ground improvement activities to limit the potential for lateral spreading and liquefaction-induced settlement would occur within the riparian management area and riparian buffer area of the Columbia River. The City has defined the riparian management area along the Columbia River as land 100 feet from the OHWM. The riparian buffer is defined as the area an additional 75 feet landward from the riparian management area. Both of these areas are subcategories of the Fish and Wildlife Conservation Areas that would be regulated by VMC 20.740 if this Project were not within EFSEC's jurisdiction.

Existing development at the location of the proposed Facility site has established impervious surfaces at the top of the bank, which limits the extent of the regulated riparian management area to the area located between the OHWM and these impervious surface areas. If VMC 20.740.110(C)(1)(a) were applicable, it specifies that any work within the regulated area shall result in no-net loss of functions. Because the shoreline in this area is composed of riprap with no high-quality riparian vegetation present, Project activities at Berths 13 and 14 including proposed ground improvements would result in no-net loss of riparian functions. Therefore, impacts within the riparian management area from construction, operation and maintenance, and decommissioning activities would be minor.

Project activities at Berths 13 and 14 in the marine terminal (Area 400) including proposed ground improvement activities would occur in frequently flooded areas. All in-water structures would be designed to withstand elevated river levels during flood events. Other proposed construction activities and improvements are not expected to increase the water surface elevation of the base flood or result in a net loss of flood storage capacity. Therefore, impacts within frequently flooded area from construction, operation and maintenance, and decommissioning activities would be minor.

The proposed Facility is located in a geologic and seismic hazards area with moderate-to-high potential for liquefaction or dynamic settlement. Section 3.1 discusses geologic hazards at the Facility site including mitigation measures for consideration. Without proper seismic engineering design, ground motion from an earthquake could have moderate to major impacts to the proposed Facility elements. For a

1 If EFSEC had found the site to be inconsistent or noncompliant, EFSEC would have considered whether to recommend to the governor that the state preempt the inconsistent or noncompliant provisions. EFSEC's procedures for making this determination are in WAC 463-28.

non-EFSEC project, VMC 20.740.130 (C)(2) subjects geologic hazards related to liquefaction or dynamic settlement to seismic standards established in the adopted building code. The Applicant has committed to designing and constructing all elements of the proposed Facility in accordance with appropriate seismic design standards and building codes to reduce the likelihood of negative impacts from ground motion during an earthquake.

Consistency with the Shoreline Master Program

A number of Project elements associated with the proposed Facility would be located within areas with Aquatic and High Intensity shoreline designations applicable to non-EFSEC facilities, including modifications to the existing rail loops, dock improvements, and other activities associated with ship loading within the marine terminal (Area 400). Such water-dependent industrial uses would be permitted activities within these shoreline designations, with no setback or height limits. Table 3.10-4 shows relevant development standards for the Aquatic and High Intensity shoreline designations from the City's SMP Table 6-1. As shown, the proposed Facility would meet most of the SMP development standards for the Aquatic and High Intensity shoreline designations that would apply if this Project were not an EFSEC project, except for the proposed railroad improvements adjacent to the Columbia River, which would require shoreline conditional use approval.

Table 3.10-4. Applicable Shoreline Master Program Use, Modification, and Development Standards

Shoreline Designation	Aquatic	High Intensity
Shorelines Uses		
Boating uses		
Docks, piers, mooring buoys	Permitted	Permitted
Setback	0 foot	0 foot
Industrial Uses		
Water-dependent	Permitted	Permitted
Setback	0 foot	0 foot
Height:		
-0-100 feet from OHWM	Unlimited	Unlimited
- > 100 feet from OHWM	Unlimited	Unlimited
Parking		
Accessory use	Prohibited	Permitted
Setback	Not Applicable	50 feet
Height	Not Applicable	35 feet
Transportation use		
Highways, arterials, railroads	Conditional Use*	Permitted*
Right-of-way setback	0 foot	100 feet*

Table 3.10-4. Applicable Shoreline Master Program Use, Modification, and Development Standards

Shoreline Designation	Aquatic	High Intensity
Shoreline modifications		
Maintenance dredging	Permitted	Not Applicable

Source: City of Vancouver 2012, Table 6-1

Note:

*See 6.3.13(6) - Transportation Facility development shall not be permitted in the Aquatic shoreline designation including associated wetlands or in the setbacks of adjacent Medium Intensity or High Intensity shoreline designations except as a conditional use when all structural or upland alternatives have proven infeasible and the transportation Facility is necessary to support water-dependent uses or essential public facilities consistent with this program.

OHWM = ordinary high water mark

3.10.3.2 Rail Transportation

Because the unit trains transporting crude oil from Williston, North Dakota, to the Port of Vancouver would use existing BNSF rail lines, no direct impact would occur to existing or proposed land uses within the rail corridor study area. Because no additional land would be acquired along the rail corridor for new or expanded rail facilities directly related to the proposed Facility, land use impacts would be negligible.

Land use plans in urban areas typically take into account the presence of existing rail infrastructure and encourage the development of compatible land uses in areas near major rail lines. For example, the comprehensive plans for the cities of Pasco and Kennewick, Washington, designate most areas along the proposed rail route within their jurisdictions as Industrial (City of Kennewick 2013, City of Pasco 2007). In some communities along the rail route existing land use within the rail corridor is not as compatible with rail operations as is industrial land use. In these areas, due to historical development patterns or restrictive topography, residential and commercial land uses are often located immediately adjacent to the railroad right-of-way. This pattern can be seen along the rail corridor east of downtown Vancouver and in many of the small towns along the Columbia River.

The four trains per day that would serve the proposed Facility could negatively affect existing land uses located along the rail corridor due to increased rail traffic and associated noise. However, the magnitude and duration of these types of impacts would be minor compared to the existing levels of these types of impacts from existing rail traffic. Similarly, impacts to the Waterfront Development Project from normal rail operations are also expected to be minor. Recently completed road and railroad improvements in the vicinity of the development including several grade separation projects (Street) have eliminated potential conflicts between trains and vehicles. In addition, various design features expected to be incorporated into the development, including additional sound proofing and locating residential units on the interior of the development, are expected to minimize train-related noise impacts.

3.10.3.3 Vessel Transportation

Normal vessel operations would require no improvements to the marine navigation channel or adjacent upland areas along the vessel route. The navigation channel and adjacent land uses are not expected to change as a result of the shipping traffic associated with the proposed Facility. Therefore, impacts to land use would be negligible.

3.10.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to land and shoreline use from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to land and shoreline use at the Port beyond existing conditions. If the No Action Alternative results in the development of new or expanded crude-by-rail terminals in other West Coast locations, including the Columbia River, Grays Harbor, Puget Sound, and/or the Salish Sea, those facilities would be subject to similar environmental reviews and land and shoreline use approvals to ensure consistency with applicable land use plans and zoning.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Such facilities would likely be approved only if the facilities were consistent with applicable City of Vancouver land use plans and zoning and the developer received all required permits and approvals. If such facilities require improvements in the Columbia River, additional approvals could be required from the USACE, WDNR, and the USCG.

3.10.5 Mitigation Measures

The design features and BMPs the Applicant proposes to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to land and shoreline use in this Draft EIS. EFSEC has not identified any additional mitigation measures to reduce impacts to land and shoreline use.

3.10.6 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to land and shoreline use have been identified.

3.11 VISUAL RESOURCES

This section addresses visual impacts from construction, operation and maintenance, and decommissioning of the proposed Facility and visual impacts from unit trains and vessels associated with the proposed Facility. The existing character of the visual setting at the proposed Facility site and along the rail and vessel corridors is described including the land cover, predominant landforms, cultural patterns, and significant views. The types of viewers who would be sensitive to changes in the visual setting (e.g., recreational boater) as well as the types of impacts these sensitive viewers could experience (e.g., light and glare) are identified. Visual impacts and measures to mitigate such impacts are presented.

3.11.1 Methods of Analysis

This section provides a summary of the Applicant's and EFSEC's methods for collecting data, preparing visual simulations, describing the existing visual conditions, and characterizing impacts. Impact analyses of visual resources are typically conducted using an analytic method developed by the agency that is proposing a particular project or manages the land where a particular project would be constructed. For example, impacts from a transmission line that crosses USFS land would be analyzed using the USFS's Handbook for Scenery Management (USFS 1995). The handbook provides methods to describe the existing scenic quality of a particular setting and to identify sensitive viewers potentially impacted by a project, and provides an analytic approach to characterize visual impacts. However, since EFSEC does not have its own method for analyzing visual impacts and because the proposed Facility is not located on land managed by an agency with its own method for assessing visual impacts, an independent method for analyzing visual impacts was required.

The Applicant developed a custom method based on principles and techniques of established visual resources analytic methods and conducted an initial visual impact analysis for the proposed Facility (BergerABAM 2015). EFSEC conducted an independent evaluation of the Applicant's initial visual impact analysis through review of maps, aerial photographs, and other information for the Vancouver area. EFSEC determined that the inventory and sensitive viewpoints identified by the Applicant were sufficient to identify visual impacts from the proposed Facility. However, instead of using the method of visual impact analysis developed by the Applicant, EFSEC used the BLM Visual Resources Management (VRM) methodology to describe the existing scenic quality and impacts from the Project. This analytic method was selected because it is one of the most commonly employed methods of visual impact analysis and provides a known framework for characterizing and determining impacts to visual resources.

The study area for assessing impacts to visual resources includes the following:

- Areas immediately adjacent to the proposed Facility extending approximately 1.5 miles in all directions to account for visual impacts to residential and recreation areas where topography may provide views of the proposed Facility.
- The rail corridor within Washington state from the Washington-Idaho border to the Port of Vancouver, including a 0.5-mile buffer along both sides of the rail line that encompasses portions of Washington and Oregon where views of the rail line could be visible.
- The rail route outside of Washington from the Washington-Idaho border to Williston, North Dakota.
- The vessel route from the marine terminal to 3 nmi beyond mouth of the Columbia River, including a buffer area extending 1 mile inland from the river's edge, that encompasses portions of Washington and Oregon where views of vessels could be visible.

- The vessel transits within the Pacific Ocean beyond the 3-nmi boundary past the mouth of the Columbia River.

The Applicant conducted an inventory of the existing visual conditions at the proposed Facility site and within the vicinity to identify areas of impact to sensitive viewers or visual resources. Aerial images, site photographs, and maps of the area were analyzed to identify sensitive viewpoints. The Applicant performed field reconnaissance to document the visual character of the area and identify visibility of proposed Facility features and took photographs including views from directly adjacent to the proposed Facility from the roadway and the Columbia River as well as more distant views from developed residential and recreation areas. The Applicant described the existing characteristics of the sensitive views and types of viewers identified in the inventory (BergerABAM 2014).

The Applicant prepared visual simulations to portray the appearance of proposed Facility elements from each viewpoint. Three dimensional (3-D) models of Facility elements were developed with a combination of AutoCad, Google Sketchup Pro, and Adobe Photoshop and were superimposed over the high-resolution digital photographs to provide a simulation of the appearances of proposed Facility structures and landscape improvements within the existing visual setting. Impacts were assessed based on the level of change and expectations of views of an industrialized area (BergerABAM 2014).

EFSEC conducted an independent evaluation of potentially sensitive viewpoints identified by the Applicant using the BLM’s VRM system. Using this approach, EFSEC evaluated each viewpoint or Key Observation Point (KOP) to establish a baseline scenic quality rating using key factors identified in the BLM Scenic Quality Rating Form (BLM 1986a). These factors include landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. EFSEC also established a viewer sensitivity rating for each KOP to reflect the level of public concern for scenic quality at that area. The sensitivity level was established by considering the types of users, number of users, public interest, adjacent land use, and areas requiring special protection of visual values.

Using the visual simulations prepared by the Applicant, EFSEC evaluated the level of change from the Project for each KOP using the BLM VRM Contrast Rating Process (BLM 1986b). This process was used to establish a level of contrast created by proposed Facility elements from existing conditions based on the timeframe of the change and the degree of contrast in form, line, color, and texture. The distance, angle of observation, length of time Facility elements would be in view, relative size, season of use, light conditions, recovery time, spatial relationships, atmospheric conditions, and motion were also considered when establishing the degree of contrast as well as the viewer sensitivity, sensitivity level, and scenic quality rating of each KOP.

A level of impact was assigned to each KOP based on the level of contrast between Facility elements and the surrounding landscape; a negligible impact level was assigned if no contrast occurred; a minor level of impact was assigned where a weak or moderate level of contrast occurred in a low or medium scenic quality area; a major level of impact was assigned where a strong contrast occurred in a minimally altered or highly scenic area.

A detailed inventory of visual resources along the rail and vessel corridors was not conducted because these study areas are so large and because rail and vessel traffic currently use these areas and so are part of the baseline for the visual setting in these areas. Instead, the general character of these areas was described using information available from maps, aerial photographs, and other sources using relevant concepts from the VRM method. Sensitive viewers in these areas were identified using information on recreational and tourist use. Visual impacts from the increase in rail and vessel traffic associated with the proposed Facility were described qualitatively and an impact level assigned (i.e., negligible, minor, moderate, or major).

3.11.2 Affected Environment

3.11.2.1 Proposed Facility

The visual setting for the proposed Facility consists of pockets of urbanized and industrialized areas set amidst the Columbia River lowlands. Distant views of undulating hills covered with evergreen and deciduous trees serve as a backdrop for the proposed Facility. Dominant natural features consist of the Columbia River, Vancouver Lake, and Vancouver Lake Lowlands. The immediate setting is industrialized with low buildings set on large paved lots. The land is generally flat with the original contours modified by riverbank stabilization and the addition of fill. Small office buildings, rail lines, grain terminals, and other industrial facilities used for manufacturing, shipping, and receiving are also present. Buildings and structures are typically concrete or metal construction with simple building facades.

Areas to the west of the proposed Facility present more natural aesthetic views with open space and greenway zones reserved for the protection of agriculture and wildlife. Nearby recreation areas include Shillapoo Wildlife Area, Frenchman’s Bar Regional Park, Vancouver Lake Regional Park, and other land owned by the State and managed for wildlife. Several nearby roads are popular spots for bicyclists and the Columbia River is used by recreational boaters. To the north and the east of the proposed Facility, small and medium-sized homes of the residential areas of the city of Vancouver cover the hills. The residences were generally constructed in the middle part of the 20th century using materials and designs common to that period.

Viewer Sensitivity

Based on surrounding land uses, the proposed Facility site is most frequently viewed by workers at the Port, people engaged in recreational activities near the proposed Facility site, local residents, and motorists. A viewer’s activity often influences their sensitivity to the visual environment. Residents or visitors to parks or recreation areas typically are more stationary and view an area over an extended period of time, and the surrounding scenery is often an important aspect of their experience. Alternatively, motorists typically experience a particular view only for a short period of time and are engaged in other activities that occupy their attention. Motorist sensitivity is generally lower unless they are traveling on roads known for their visual quality, such as scenic byways. Workers may observe a particular area frequently but are also engaged in other activities and would not be considered sensitive viewers because the facilities planned for the Project are similar in visual character to the existing land uses and would not draw their attention. Sensitive viewers could also include members of Indian tribes who use lands and waters near the proposed Facility. Members of Indian tribes would likely be very sensitive to changes in the visual environment.

Sensitive Views

The proposed Facility site is visible from a close distance from several viewpoints including the Columbia River and NW Lower River Road, and would also be visible in the distance from residential areas to the east. Using photographs provided by the Applicant, EFSEC developed a scenic quality rating for each KOP using the BLM VRM methodology. Figure 3.11-1 shows the location of each KOP and the direction of the view. Table 3.11-1 provides the name, location, viewer type, viewer sensitivity, Scenic Quality Rating, and Sensitivity Level of each KOP.

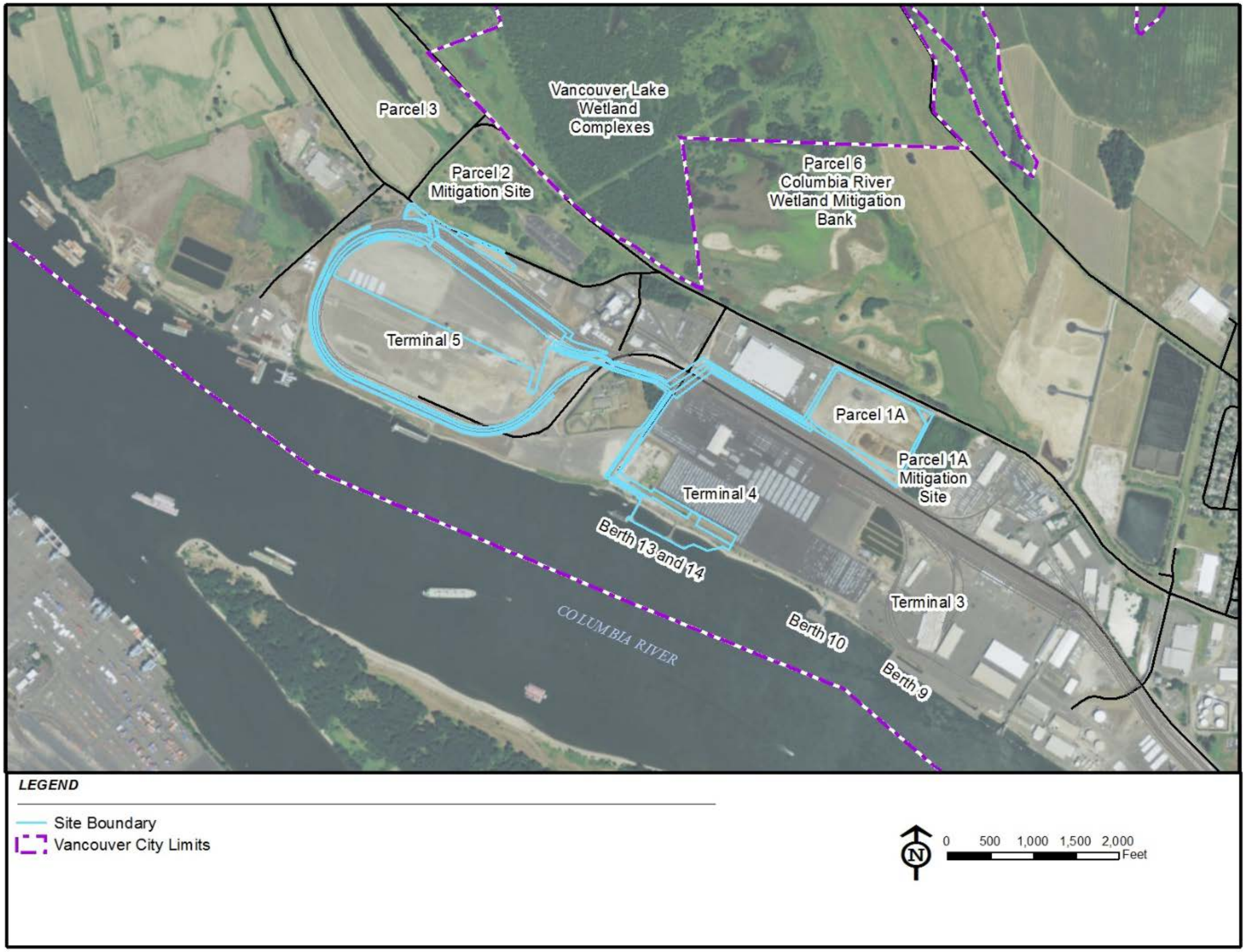

Figure 3.11-1. Locations of Key Observation Points

Table 3.11-1. Key Observation Point Summary

KOP	Location	Viewer Type	Viewer Sensitivity	Scenic Quality Rating	Sensitivity Level
1	NW Lower River Rd	Recreationists Motorists Workers	Low Low Low	Low	Low
2	NW Old Lower River Rd	Workers	Low	Low	Low
3	Northwest Neighborhood	Residents	Moderate/High	Moderate	Moderate
4	Franklin Park	Recreationists	Moderate	Moderate	Moderate
5	Columbia River	Vessel Workers Recreational Boaters	Low Moderate	Moderate	Moderate

NW Lower River Road (KOP 1)

NW Lower River Road primarily functions as a transportation corridor to Port facilities, industrial sites, and nearby residences and agricultural areas. The road serves motorists, bicyclists, and pedestrians, all of whom would have views of the proposed Facility. Motorists travelling on NW Lower River Road are primarily workers. The road is not identified as a Washington State or National Scenic Byway (WSDOT 2014). The sensitivity for motorists and workers in this area is low at this viewpoint as it is a frequently travelled road, the proposed Facility would be similar in appearance to other facilities in the area, and the viewing time at this location would be limited to a few seconds. Recreational users of Vancouver Lake and Frenchman's Bar Parks, the Columbia River, and state recreation lands within Vancouver Lake Lowlands would pass the Facility but their viewing times would be brief. Viewing times at this location would vary depending on the mode of transportation and would range from several seconds for a motorist, 1-2 minutes for a bicyclist, and 3-4 minutes for a pedestrian. Recreationists and residents are assigned moderate viewer sensitivity as the area is not a Scenic Byway and views are of limited duration at this location. Viewer sensitivity for Port tenants and customers is low as the facilities are similar to those in the area.

Figure 3.11-2 shows the current view from approximately 1,500 feet of the proposed Facility location approaching the site from the east and west travelling along NW Lower River Road. Trees along NW Lower River road obscure much of the Facility site from the east. Views of the proposed Facility location are clearer as travelers continue west along NW Lower River Road. Although a vegetation buffer exists, the majority of the view has been altered with paving, a utility corridor, and buildings that exhibit utilitarian materials and designs. The scenic quality rating for this viewpoint is low and the sensitivity level is low (Table 3.11-1).

NW Old Lower River Road (KOP 2)

The NW Old River Road runs south of, and parallel to, NW Lower Road for approximately 1.6 miles to the west of the proposed Facility site. Figure 3.11-3 shows the current view of the proposed Facility location traveling from the north and west along NW Old Lower River Road. The view is approximately 800 feet from the proposed Facility location and is primarily experienced by motorists, bicyclists, and pedestrians. Although some recreational use of the roadway occurs, it primarily serves employees and visitors to the industrial facilities in the area. The sensitivity of the majority of viewers is low as the facilities are similar to those found on adjacent parcels, viewing times are typically under 3 minutes (3 minutes for a pedestrian, 1 minute for a bicyclist, under 1 minute for a motorist). The scenic quality rating and sensitivity level are low (Table 3.11-1) as the area has been extensively modified by the addition of paving transmission lines and rail corridors.

Figure 3.11-2. View from NW Lower River Road (KOP 1)

Figure 3.11-3. View from NW Old Lower River Road (KOP 2)

Northwest Neighborhood (KOP 3)

Distant views of the proposed Facility location are experienced by residents of the Northwest Neighborhood. Although some residential areas are closer to the proposed Facility location, topography would block views from those residences. The existing view from KOP 3 is shown on Figure 3.11-4. This view is primarily experienced by residents of the Northwest Neighborhood whose sensitivity level would range from moderate to high depending on their vantage point and personal visual preferences. Although distant views of rolling hills exist, much of the foreground and middle ground has been altered by Port facilities, transmission lines, and residential and industrial buildings. The scenic quality and sensitivity level for this KOP are moderate (Table 3.11-1).

Figure 3.11-4. View from Northwest Neighborhood (KOP 3)

Franklin Park (KOP 4)

Franklin Park is situated approximately 2.5 miles to the east of the proposed Facility location. Figure 3.11-5 shows the existing view from the park. The park is set on a bluff and provides views of distant hills and agricultural and industrial land in the lowlands. Although topography affords long views, much of the intervening landscape has been altered with transmission corridors and industrial buildings. The scenic quality rating is moderate. Views from KOP 4 are primarily experienced by recreationist who would likely view the scene for extended amounts of time and would likely notice changes in the visual setting. The sensitivity level of the viewpoint is moderate (Table 3.11-1).

Figure 3.11-5. View from Franklin Park (KOP 4)

Columbia River (KOP 5)

KOP 5 is the view of the proposed Facility site from the Columbia River (Figure 3.11-6). This view is primarily experienced by workers on vessels and recreationists in small boats. Viewer sensitivity for workers on vessels is low as they are typically engaged in their work but would range from moderate to high for recreational boaters depending on their vantage point, speed of motion, and personal preferences. The scenic quality rating is moderate with views of the water in the foreground, industrial facilities in the near ground on the shoreline backed by trees and other landscapes, and more distant views of rolling hills in the background. The sensitivity level is moderate (Table 3.11-1) due to the scenic quality and range of typical viewer sensitivity in this area.

Figure 3.11-6. View from the Columbia River (KOP 5)

Light and Glare

The proposed Facility would be located at the Port in an area designated as heavy industrial in the City of Vancouver Comprehensive Plan (City of Vancouver 2011). Current ambient lighting level at the site occurs from lights used at neighboring facilities, including Farwest Steel, Tri-Start Transload, Tidewater Barge Lines, CPU River Road Generating Plant, JWC, the rail corridor, marine terminals, and from car headlights along Lower River Road. Minimal light also results from distant residential and commercial areas. The Columbia River has no permanent light sources, but additional lighting is created from a designated anchorage area directly across the channel from Berths 13 and 14 and from vessels using the anchorage (BergerABAM 2014).

3.11.2.2 Rail Corridor

In the eastern and western outskirts of Spokane, the rail corridor is lined with a mixture of residential and light agricultural parcels. Although industrialized, the entire rail corridor in this area contains bridges, depots, and other resources associated with railroad development that attracts travelers, recreationists, and other sensitive viewers. Some sensitive viewers are travelers using railroads to access other destinations or recreationists using bridges or other features to access nearby recreation areas. Many other viewers visit these resources because of an interest in the engineering, architectural, or historical values of the railroads. Views of rail traffic are available throughout the rail corridor in both the near and far ground. Between Spokane and Cheney, the visual setting is residential and developed agricultural use.

Prior to crossing the Tri-Cities area, the rail corridor crosses rolling hills and agricultural lands of the Columbia Basin physiographic region. The rail line then crosses the Columbia River, traveling through industrial and residential areas of Pasco and Kennewick. Between Kennewick and Finley the railroad corridor passes inland through residential and agricultural areas before paralleling the Columbia River.

The rail corridor enters the Columbia River Gorge National Scenic Area near Wishram. The Gorge is defined by long vistas across the water, with hills rising above, and distant views of Cascade Mountains to the north and south. Although industrialized areas exist, particularly near the Bonneville Power Administration facilities at Cascade Locks and The Dalles, the scenic quality in the Gorge is high and the area receives heavy recreational use by hikers, bicyclists, and a variety of water sports enthusiasts. Leaving the Columbia River Gorge, the rail corridor passes through urbanized areas of Washougal and Camas before reaching Vancouver.

The rail corridor outside of Washington state includes a variety of landscapes with varying scenic qualities. Areas with high scenic quality include the Idaho Panhandle and Kootenai National Forest and Lake Pend Oreille in Idaho; Flathead and Kootenai National Forests, Glacier National Park, and the Blackfeet, Fort Belknap, and Fort Peck Reservations in Montana; and Lake Sakakawea and Lewis and Clark Wildlife Management Area in North Dakota.

3.11.2.3 Vessel Corridor

The visual setting for the vessel corridor on the Columbia River from the proposed Facility to 3-nmi beyond the mouth of the Columbia River includes areas on the shoreline of both Washington and Oregon that contain pockets of industrial use separated by land protected for agricultural or recreational uses. Larger communities with more developed residential and recreation areas on the Washington side of the Columbia River include Kalama, Longview, Ilwaco, and Long Beach. Larger communities in Oregon include St. Helens, Columbia City, Svensen, and Astoria. Although development is sparse, the area is scenic and attracts recreationists and other sensitive viewers. Views of vessel traffic are available throughout the corridor in both the near and far ground.

Beyond the 3-nmi boundary from the mouth of the Columbia River out into the Pacific Ocean and to receiving refineries, the landscape includes open ocean and shoreline areas, with views of vessel traffic in the near and far ground in many areas.

3.11.3 Impact Assessment

3.11.3.1 Proposed Facility

Construction

During construction, temporary changes to the visual setting near the proposed Facility would occur from the presence of construction workers, equipment, vehicles, and partially constructed structures. Storing materials and equipment would also change the visual setting.

Dust and emissions generated by construction activities could cause visual impacts, although these would be reduced to minor levels with the use of BMPs including applying water to limit dust and minimizing idling time to reduce particulate emissions.

The Applicant has stated that outdoor lighting may include limited construction lighting, and onsite safety lighting or warning flashers and most construction activities would occur during daylight hours. Light and glare from construction equipment and vehicles could impact neighboring areas, although limiting construction to daytime hours would reduce the amount of light from construction equipment headlights. In the event that construction occurs during periods of darkness, night lights would be directed toward the Facility location and be limited to the minimum wattage required for safety and operations.

The proposed Facility would adhere to requirements under VMC with regard to light and glare (VMC 20.935.030 (D)), landscape and screening (VMC 20.925), and signage (VMC 20.960), which would reduce the potential for adverse visual impacts. Since the proposed Facility would be constructed in an area with existing industrial development and activity, visual impacts from construction would be minor.

Operation and Maintenance

The storage tanks, transfer pipelines, marine terminal and other Facility elements would be similar in materials and design to structures found in other areas in the vicinity of the Port. The proposed Facility would create little contrast to the existing altered environment, therefore the impacts to visual resources from the proposed Project would be minor.

Visual simulations show the appearance of proposed Facility elements from each of the identified KOPs. The level of contrast from existing conditions was analyzed to determine impacts to sensitive viewers at each location. For example, changes in the visual setting from the proposed Facility were assigned a minor level of impact when a weak or moderate level of contrast occurs in a low or -moderate scenic quality area, while a major level of impact would be assigned where the Proposed Action would have a strong level of contrast in a minimally altered or highly scenic area. Table 3.11-2 shows the level of impact from the proposed Facility for each KOP based on review of viewer sensitivity, scenic quality rating, sensitivity level, and contrast from existing conditions.

NW Lower River Road (KOP 1)

Figure 3.11-7 shows the appearance of proposed Facility elements from NW Lower River Road. Although the storage tanks would be clearly visible from this road, the area is already heavily modified with paving and a utility corridor. Existing trees would provide screening from distant views. The level of contrast is moderate in an area with lower scenic quality and the majority of viewers have low sensitivity; therefore, the impacts at this KOP would be minor. Over time, the required landscape vegetation buffer would further reduce visual impacts in this area.

Table 3.11-2. Key Observation Points – Contrast and Level

KOP	Location	Viewer Type	Viewer Sensitivity	Scenic Quality Rating	Sensitivity Level	Contrast	Impact
1	NW Lower River Rd	Recreationists/Motorists/ Workers	Low	Low	Low	Moderate	Minor
2	NW Old Lower River Rd	Workers	Low	Low	Low	Moderate	Minor
3	Northwest Neighborhood	Residents	Moderate/High	Moderate	Moderate	Weak	Minor
4	Franklin Park	Recreationists	Moderate	Moderate	Moderate	Weak	Minor
5	Columbia River	Vessel Workers/ Recreational Boaters	Low/Moderate	Moderate	Moderate	Weak	Minor

Figure 3.11-7. View from NW Lower River Road (KOP 1)

NW Old River Road (KOP 2)

As shown on Figure 3.11-8, the boiler building would be prominently visible from NW Old River Road; however, the industrial design of the structure is compatible with the existing development in the area. The level of contrast created by the new structure from the existing paving, railroad, and utility corridor would be moderate. Additionally, the vegetation buffer would somewhat mask the structure from view by passing motorists. Visual impacts from this KOP would therefore be minor.

Figure 3.11-8. View from NW Old Lower River Road (KOP 2)

Northwest Neighborhood (KOP 3)

Figure 3.11-9 shows the view of the tank storage area from KOP 3 in the Northwest Neighborhood. Although the tank structure is visible, it blends with existing Port facilities and structures in the near and middle ground that exhibit similar industrial designs. Trees near the proposed Facility provide additional screening. The eye is drawn to the structures in the near ground and the distant hills. The level of contrast with existing conditions is weak and impacts would be minor.

Franklin Park (KOP 4)

Although Franklin Park is visited by sensitive viewers, the existing viewshed is heavily altered with transmission lines and other industrial structures. As shown on Figure 3.11-10, existing trees would shield much of the proposed Facility from view. Impacts to visual resources and sensitive viewers from this KOP would be minor.

Columbia River (KOP 5)

Figure 3.11-11 shows the view of proposed Facility elements from the Columbia River. The low profiles of the marine terminal (labelled *dock* in the figure) and the MVCU units would blend with the existing landscape. Although the storage tanks would be visible, they would not likely draw the attention of vessel workers. The visual dominance of proposed Facility elements would change based on the position of recreational boaters within the river but, overall, the level of contrast with the existing conditions would be weak and visual impacts from the proposed Facility would be minor.

Figure 3.11-9. View from the Northwest Neighborhood (KOP 3)

Figure 3.11-10. View from Franklin Park (KOP 4)

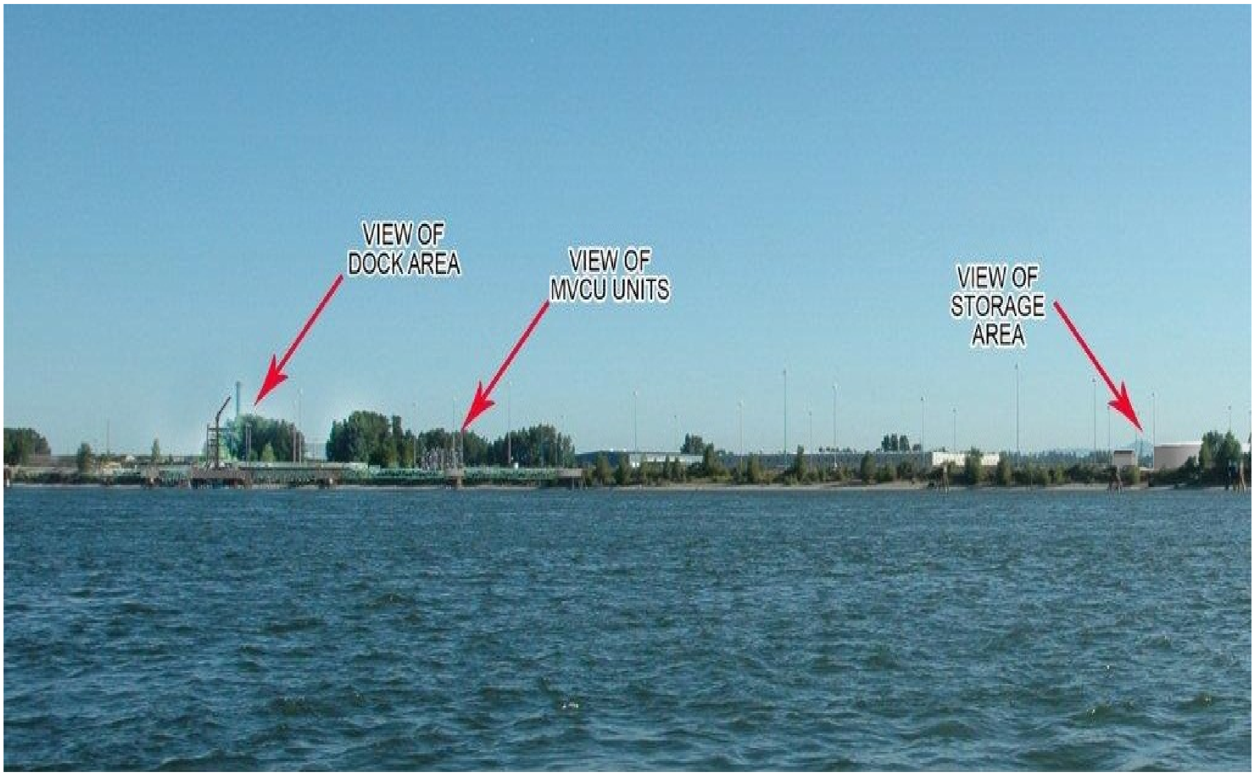

Figure 3.11-11. View from the Columbia River (KOP 5)

Light and Glare

Impacts from light and glare would be minor because neighboring properties share similar land uses, hours of operation, and security requirements. Nonreflective paint colors would be used on exterior surfaces of storage tanks to minimize impacts from glare from Facility lighting and headlights at night and direct sunlight during the day. Other proposed Facility elements would be painted with earth tones to minimize visibility and glare. Installing full cutoff light boxes, adjusting light directing, and providing additional screen with supplemental light shields or vegetation are other measures identified by the Applicant that would minimize impacts from light on neighboring properties. The proposed Facility would make minimal contribution to overall ambient light levels in the immediate vicinity. Light and glare impacts to residential areas would be minor as no residential areas lie north, south, or west of the proposed Facility. Impacts to the residential areas located 1 mile east of the proposed Facility would be limited by landforms and existing vegetation. Light and glare impacts during operation of the proposed Facility are expected to be minor.

Decommissioning

Similar to construction, during decommissioning, changes to the visual setting near the proposed Facility would occur from the presence of decommissioning workers, equipment, vehicles, and partially demolished structures. The removal of many aboveground structures, including storage tanks and the boiler building during decommissioning would reverse many of the visual impacts described for operation of the proposed Facility. However, if some structures are not removed during decommissioning, these would remain within the visual setting of the area. Visual impacts from decommissioning activities are anticipated to be minor.

3.11.3.2 Rail Transportation

Approximately four additional trains per day would be visible along the rail corridor between the Washington-Idaho border and the Port. Visual impacts would be greatest in highly scenic areas such as the Columbia River Gorge, where an increased number of trains would be visible from scenic viewpoints and recreation areas. However, as trains are currently part of the visual setting of all areas along the rail line, additional trains in the system would result in an increase in the frequency and the length of time that trains would be running and in view, but would not add a new type of visual impact to the existing rail corridor. Visual impacts from unit trains associated with the proposed Facility would therefore be minor.

Investigations into impacts to air quality and visibility within the Columbia River Gorge have been conducted by Oregon Department of Environmental Quality (ODEQ) and other agencies several times. Examples include the 2008 inventory of sources of visibility impairment in and around the Gorge (ODEQ 2008); the Columbia River Gorge Air Quality Study Science Summary Report (Pitchford et al. 2008); and the 2011 ODEQ Columbia River Gorge Study and Strategy (ODEQ 2011). The Pitchford et al. (2008) study and the 2011 ODEQ report both identify locomotives as a factor contributing to haze in the Columbia River Gorge but acknowledge that the majority of haze results from sources outside of the Gorge. The 2008 emission inventory provided estimates for 2004 sources of emission in the Gorge with projections to 2018. This report estimated that locomotive emissions within the Gorge would *decrease* from 12 tons/day in 2004 to 9 tons/day in 2018 (i.e., −25 percent) for all pollutants, at which point locomotives would represent about 38 percent of all man-made pollutant emissions within the Gorge. Additionally, the total projected 2018 pollutant emissions from sources within the Gorge from both man-made and natural sources was expected to account for only 1 to 2 percent of the emissions from sources outside of the Gorge (ODEQ 2008). Although detailed studies were not completed for this EIS, the additional trains associated with the proposed Facility are not expected to significantly contribute to haze or otherwise impact visibility in the Gorge because the overall percentage of emissions from locomotives compared to other sources would continue to be low, particularly relative to sources of emissions from outside of the Gorge.

Visual impacts from trains using rail corridors outside of Washington State (from Idaho to North Dakota) would be similar in nature to those within 0.5 mile of the rail corridor in Washington. Trains are currently part of the visual setting of the areas along rail lines, so the impact from additional trains may result in an increase in the frequency and the length of time that trains would be running and in view, but the additional trains would not add a new type of impact to the existing rail corridor. In addition, outside of Washington State, trains could use a greater number of routes to crude oil loading stations, so trains would be more dispersed. Visual impacts for trains using corridors outside of Washington State would be negligible in the event that trains use dispersed routes and would be minor if all four trains per day use the same rail route.

3.11.3.3 Vessel Transportation

Approximately one additional vessel per day would be visible along the Columbia River and Washington coast. As large vessels are currently part of the visual setting of all areas along the vessel corridor, additional vessels would result in an increase in the frequency and the length of time that vessels would be in view, but would not add a new type of visual impact to the Columbia River and Washington coast. As such, a minor impact would occur from the additional vessels, due to an increase in the frequency and the length of time viewers see vessel traffic of this type (Ecology 2014).

Air pollution from ocean-going ships has been identified as one of the more significant emission source categories to influence visibility in the Gorge (ODEQ 2011). However, as described in Section 3.2.3.3, decreases in vessel emissions are anticipated as a result of the MARPOL Convention and other regulations to reduce air pollution from ships. Vessels transporting crude oil from the proposed Facility would meet these requirements, which would reduce potential visual impacts from emissions, haze, or visibility in the area.

Vessels transiting beyond the 3-nmi boundary past the mouth of the Columbia River through the Pacific Ocean to receiving refineries would merge with a multitude of vessel traffic, including large container ships. The increase of one vessel (two trips) per day in these areas would not be noticeable from existing conditions, resulting in negligible impacts to visual resources beyond the 3-nmi boundary past the Columbia River.

3.11.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant’s request to construct and operate the proposed Project at the Port, and the following impacts to visual resources from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no impacts to visual resources.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Construction and decommissioning of such a facility would impact visual resources at the Port in much the same way as described for the proposed Facility, and long-term visual impacts would depend on the design and materials of the selected project. Given the level of alteration and current visual quality of areas near the proposed Facility, visual impacts from most new facilities would be expected to be minor.

3.11.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to visual resources in this Draft EIS. EFSEC has not identified any additional mitigation measures to reduce impacts to visual resources.

3.11.6 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to visual resources have been identified.

3.12 RECREATION

Recreation is defined in this EIS as activity for pleasure or relaxation in an outdoor setting. Recreation may include boating, bird watching, fishing, hunting, hiking, and biking, as well as numerous other activities. Tribal fishing and hunting is addressed in Section 3.13.

Recreation may occur in formally designated areas such as parks or informally such as on a network of city streets. Recreation may take place in areas managed by state, local, or federal agencies, at private facilities such as a tennis club, or on conservation lands owned by nongovernmental organizations.

3.12.1 Methods of Analysis

The analysis of impacts to recreation considered impacts from the proposed Facility construction and operations as well as from rail and vessel transportation, including access to recreation areas, disturbance from noise, and alterations to scenic quality. The study area to assess impacts to recreation includes the following:

- **The proposed Facility study area**—for recreational resources includes designated recreation areas and dispersed recreational activities that take place within 2 miles[1] of the proposed Facility.
- **The rail corridor study area**—within Washington includes designated recreation areas within 0.5 mile on either side of the rail corridor, and within 0.25 mile on either side of the rail-Columbia River corridor within Washington and Oregon. The rail corridor study area outside of Washington and Oregon includes general recreation areas traversed or within close proximity (within 0.5 mile) of the rail line from the Washington-Idaho border to Williston, North Dakota.
- **The vessel corridor study area**—includes designated recreation areas and facilities within 0.25 mile of the Columbia River shoreline from Vancouver, Washington, to 3 nmi beyond the Columbia River mouth. The vessel corridor study area outside of the Columbia River includes general recreation areas farther than 3 nmi beyond the Columbia River mouth into the Pacific Ocean and to receiving refineries.

Designated recreation areas, known undesignated recreation areas, and planned recreation areas were identified for areas within 2 miles of the proposed Facility. The 2-mile limit was selected because it incorporates adjacent and nearby recreation areas in the vicinity, including recreational use of the Columbia River. Designated recreation areas were identified for areas along the rail and vessel corridors. Direct disturbance of recreational activities and access delays were evaluated by overlaying the study areas onto maps of the recreation areas. The extent of noise and visual disturbances was also viewed spatially to determine whether these disturbances would affect recreational sites.

For areas along the rail line from the Washington-Idaho border to Williston, North Dakota, and on vessel routes from 3 nmi beyond Columbia River mouth into the Pacific Ocean and to receiving refineries, an inventory of recreation areas was not completed as these areas are so large and because rail and vessel traffic currently use these areas and so they are part of the existing baseline. Impacts from an increase in rail and vessel traffic associated with the proposed Facility was assessed qualitatively for these more distant areas.

1 The 2-mile limit was selected because it incorporates adjacent and nearby recreation areas in the vicinity, including recreational use of the Columbia River.

3.12.2 Affected Environment

This section describes identified recreation areas, the locations of which are shown in Appendix P.6.

3.12.2.1 Proposed Facility

This study area includes areas within 2 miles of the proposed Facility.

Parks and Recreation Areas

No developed parks or recreation areas are located within the proposed Facility site itself, although a number of formally designated recreational sites are located within 2 miles of the proposed Facility. The City of Vancouver maintains 9 recreational facilities and parks within this study area including Brickyard Park, Burnt Bridge Creek Greenway Trail, Carter Park, Franklin Park, Fruit Valley Park, Hidden Park, John Ball, Liberty Park, and South Vancouver Lake Lowlands. Furthermore, the City of Vancouver is planning the development of two parks within the study area: Heathergate Ridge Park and Lynch Park. Table 3.12-1 lists designated recreational sites within the proposed Facility study area, and Appendix P.6 and Figure 3.12-1 shows the locations of these recreation areas.

Clark County maintains two recreational sites within the proposed Facility study area, Vancouver Lake Park and Frenchman's Bar Park, and the WDFW maintains Shillapoo Wildlife Area.

The Vancouver School District maintains recreational facilities and play areas at four schools within the proposed Facility study area, including Fruit Valley Community Learning Center, Hough Elementary, Lincoln Elementary, and Franklin Elementary.

Recreation areas within the proposed Facility study area in Oregon include Kelley Point Park, Smith & Bybee Wetlands and Natural Area, and undeveloped Belle Vue Point County Park.

Private recreation areas within this study area include Vancouver Lake Sailing Club and Lakeview Par 3 Golf Challenge.

Trails

Numerous trails are located within the proposed Facility study area, but not within the proposed Facility site itself. Many developed recreational sites identified in Table 3.12-1 have trails within park boundaries, including Vancouver Lake Park (2.5-mile trail), Frenchman's Bar Park (2.8-mile trail), Shillapoo Wildlife Area, Fruit Valley Park, Kelley Point Park (1.7-mile trail), and Smith & Bybee Wetlands Natural Area (1-mile trail).

In addition to trails specifically located in parks, a number of other trails are located within the proposed Facility study area, including Lower Columbia River Water Trail (146-mile trail), Willamette River Water Trail, Columbia Slough Water Trail, Burnt Bridge Creek Greenway Trail (8-mile trail), Vancouver Lake Water Trail (32-mile trail), NW Lower River Road (SR 501), Marine Drive Trail, Lewis and Clark Discovery Greenway Trail, and Lower River Road Multi-Use Trail (4.5-mile trail). Individual trail characteristics are briefly described below:

- Lower Columbia River Water Trail provides recreational users with access to public launch and landing sites, camping, and sites of interest along the 146-mile-long water trail that extends from Bonneville Dam to the Columbia River mouth. This section of Lower Columbia River Water Trail is part of the 3,700-mile-long Lewis and Clark National Historic Trail.
- The Willamette River Water Trail is a 217-mile-long trail managed by Willamette Riverkeeper.

- Columbia Slough Water Trail is a water trail running from Columbia Slough's confluence at the Willamette River to Fairview Lake.
- Burnt Bridge Creek Greenway Trail is a hard-surfaced shared-use trail. The trail ends at Stewart's Glen in Fruit Valley and extends to NE 90th Avenue (City of Vancouver 2015a).
- The Vancouver Lake Water Trail is a 32-mile-long water trail for canoers, kayakers, and paddle boarders, which includes Vancouver Lake and extends to Woodland, Washington (Vancouver-Clark Lake Parks & Recreation 2013).
- NW Lower River Road (SR 501) is a popular bicycling route providing access to Vancouver Lake and rural roads in the Vancouver Lake area.
- Marine Drive Trail connects Kelley Point Park to Troutdale. The trail follows Marine Drive (Metro 2014). The trail connects to the Columbia Slough Trail at Kelley Point Park. The Columbia Slough Trail continues to Blue Lake Regional Park.
- Lower River Road Multi-Use Trail will be a 4.5-mile multiuse path running from the intersection of SR 501 and Mill Plain Boulevard to the Vancouver Lake Flushing Channel. Three segments of the trail have been developed and five trail segments remain undeveloped.
- Lewis and Clark Discovery Greenway Trail extends from Washougal to Ridgefield. The multiuse trail accommodates walking, bicycling, and in some sections horseback riding. Approximately 9.5 miles of the planned 46.1-mile-long trail has been constructed.

Table 3.12-1. Designated Recreational Sites in Proposed Action Study Area

Manager	Park/Resource	Description
State		
Washington Department of Fish and Wildlife	Shillapoo Wildlife Area - South Unit	1,012-acre unit, trails, trails, upland bird and waterfowl hunting, fishing, trap shooting, archery
	Shillapoo Wildlife Area - Vancouver Lake Unit	477-acre unit at the southern end of Vancouver Lake, boat launch, trails, upland bird and waterfowl hunting, fishing, trap shooting, archery
Local		
Clark County	Frenchman's Bar Park	120-acre regional park, 2.5-mile trail, river access, beach, volleyball courts, playground, picnic shelters, restrooms
	Vancouver Lake Park	234-acre regional park located along the western shore of Vancouver Lake, 2.5-mile trail, lake access, beach, playground, picnic shelters, restrooms, hand-launched boat access, Vancouver rowing club
Metro	Smith & Bybee Wetlands Natural Area	Approximately 2,000-acre natural area, 1-mile trail, wildlife viewing platforms, boat launch
Portland	Columbia Slough Trail	22-mile paved/unpaved pathway along Marine Drive from Kelley Point Park to Blue Lake Regional Park
	Marine Drive Trail	19-mile trail near completion paralleling the Columbia River from Kelley Point Park to Troutdale
	Kelley Point Park	104-acre multiuse park, canoe/kayak launch, restroom, historic site, trails, picnic tables, access to Columbia and Willamette rivers

Table 3.12-1. Designated Recreational Sites in Proposed Action Study Area

Manager	Park/Resource	Description
Vancouver	Brickyard Park	2-acre park, open area, playground, benches, trails, picnic table, basketball
	Burnt Bridge Creek Greenway Trail	8-mile hard-surfaced shared-use trail
	Carter Park	0.7-acre park, playground, benches, and picnic tables
	Franklin Park	12-acre park, playground, sport fields, picnic tables
	Fruit Valley Park	6-acre park, playground, pathways, and picnic tables
	Heathergate Ridge*	2.2-acre undeveloped park
	Hidden Park	1.2-acre park, playground, multiuse field, and bench
	John Ball	Open area, playground, and picnic tables
	Lewis and Clark Discovery Greenway Trail	46.1-mile trail extending from Washougal to Ridgefield, with 9.5 miles of trail currently built
	Liberty Park	0.2-acre park with playground developed in conjunction with the completion of the Mill Plain Blvd. extension
	Lynch Park*	9.6-acre undeveloped park
	South Vancouver Lake Lowlands	873-acre natural area
	Vancouver Lake Water Trail	32-acre recreational water trail extending from Vancouver Lake to Woodland
Multnomah County	Belle Vue Point County Park	Undeveloped park.
Vancouver School District	Franklin Elementary	Elementary school, playground and soccer field
	Fruit Valley Community Learning Center	Elementary school, playground and soccer field
	Hough Elementary	Elementary school, playground and soccer field
	Lincoln Elementary	Elementary school, playground and soccer field
Port of Vancouver	Lower River Road Multi-Use Trail	4.5-mile trail along SR 501. Segments of the trail are developed and undeveloped.
Private/Other		
	Lakeview Par 3 Golf Challenge	Golf course
	Vancouver Lake Sailing Club	Small boat sailing club
	Lower Columbia River Water Trail	146-mile recreational water trail extending from Bonneville Dam to the Columbia River mouth
	Willamette River Water Trail	217-mile water trail running from Buena Vista Ferry to the Willamette River mouth
	Columbia Slough Water Trail	A water trail running from the confluence with the Willamette River east to Fairview Lake

*undeveloped park

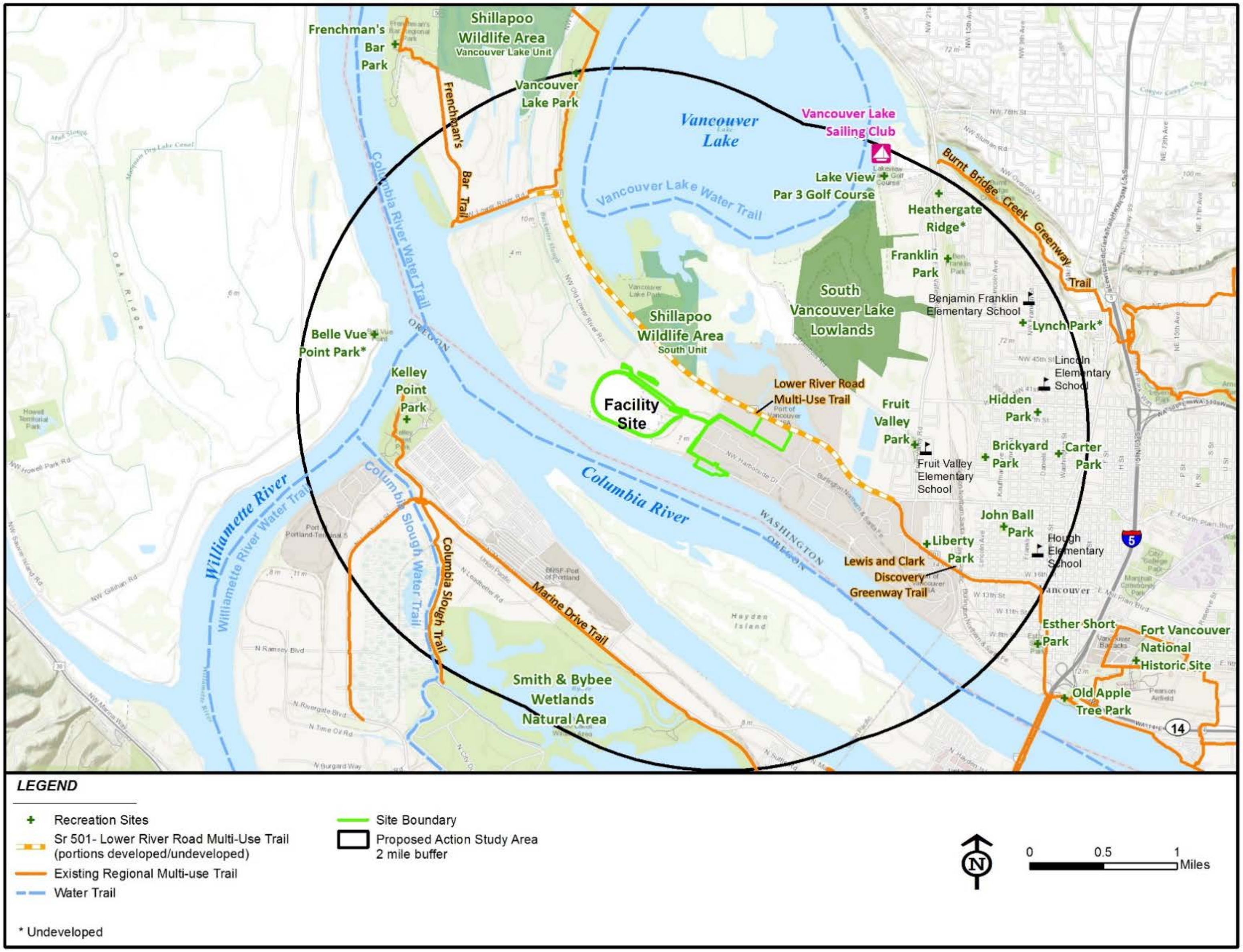

Figure 3.12-1. Recreational Sites within Proposed Action Study Area

Hunting

The WDFW and ODFW regulate hunting within the proposed Facility study area. The designated hunting site nearest to the proposed Facility is the Vancouver Lake Unit of Shillapoo Wildlife Area. This 477-acre recreational site is located approximately 1,100 feet north of the administrative buildings and railcar unloading area (Area 200) and 1,800 feet north of the storage tanks (Area 300). The Vancouver Lake Unit of Shillapoo Wildlife Area is popular with the public and receives a wide variety of uses due to its close proximity to the City of Vancouver (WDFW 2015a). The 1,012-acre South Unit of Shillapoo Wildlife Area is located approximately 2 miles northwest of the proposed Facility.

The WDFW primarily manages the Vancouver Lake Unit and South Unit of Shillapoo Wildlife Area for wintering waterfowl habitat and as designated pheasant release sites for recreational hunting. Pheasant hunting season is September 20 to November 30 (WDFW 2014a), while the general goose hunting season is November 8 to 30 and December 10 to January 15 (Saturdays, Sundays, and Wednesdays only), and duck hunting season is September 20 to 21, October 11 to 15, and October 18 to January 25.

Water-Based Recreation

Numerous rivers and waterbodies are located within the proposed Facility study area, such as the Columbia River, the confluence of the Willamette River, and Vancouver Lake. Each of these waterbodies is used for boating (including motorized boating and nonmotorized kayaking and canoeing), fishing, and other forms of water recreation.

Boating

Recreational boating within the proposed Facility study area is common given the proximity of numerous Hayden Island marinas, which are located approximately 3 to 4.5 miles southeast of the proposed Facility. Hayden Island serves as a key location for recreational boaters traveling to different sections of the Columbia or Willamette rivers (Port of Portland 2010). Kayaking and canoeing occurs regularly within this study area (Port of Portland 2010). The nearest nonmotorized public boat launch is approximately 1.6 miles to the west of the proposed Facility at Kelley Point Park, where launch facilities for small, hand-launched vessels (canoes/kayaks) are located.

The only motorized boat launch located within the proposed Facility study area is the WDFW-operated boat launch on the southern shore of Vancouver Lake (WDFW 2015b). Vancouver Lake Sailing Club, a private sailing club, is located along the southeastern shore of Vancouver Lake. The nearest motorized boat launch along the Columbia River is at the City of Vancouver's Marine Park located approximately 4.5 miles upriver from the proposed Facility. The nearest public dock/moorage to the proposed Facility is approximately 3 miles upriver at the Port-owned Terminal One (Vancouver Landing) site in downtown Vancouver.

Recreational Fishing

Both the Columbia and Willamette rivers support salmon, steelhead, small mouth bass, shad, and sturgeon fisheries within the proposed Facility study area. Vancouver Lake also has an abundance of crappie, largemouth bass, channel catfish, yellow perch, and carp (WDFW 2015b).

Catch and release fishing for sturgeon is currently allowed year-round; however, retention of caught fish is prohibited (ODFW 2015a). Warm-water game fish species season is also year-round on this section of the Columbia River (ODFW 2015b). The spring Chinook and steelhead fishery for the Columbia River is open from January to March and depending on fishery management decisions, the season could extend into June (ODFW 2014). Chinook and coho salmon fishing season is from August to December.

It is estimated that in 2014 approximately 12,600 spring Chinook fishing trips occurred within the Columbia River from Light #40 (near the Willamette River/Columbia River confluence) to Lower Lemon

Island, while it is estimated that nearly 5,300 trips occurred for fall Chinook in this same location in 2013 (Sall, pers. comm., 2015).

3.12.2.2 Rail Corridor

Parks and Recreation Areas

The rail corridor study area within Washington and Oregon includes multiple formal designated recreational sites and informal open-space areas used for recreation. Recreational sites include state and local parks, state and federal public lands, and other private recreational facilities such as golf courses, yacht club, and tennis clubs. Table 3.12-2 identifies major recreational facilities in the rail corridor study area within Washington and Oregon (Appendix P.6). Federal agencies managing major recreational sites within the rail corridor study area include the BLM (1 site), USFS (10 sites), National Park Service (NPS) (1 site), USFWS (7 sites), and USACE (29 sites).

The BLM manages the Lower Deschutes Wild and Scenic River. Fall steelhead fishing is the predominant use in this section of the river with lesser amounts of whitewater boating and trout fishing. Most use in this segment is by motorized boat (BLM 1993).

The USFS-managed Columbia River Gorge National Scenic Area is a major recreation area beginning east of Vancouver, Washington (and Portland, Oregon in the other side of the river), stretches approximately 83 miles from the Sandy River on the west to the Deschutes River on the east in Oregon, and from Gibbons Creek in Clark County to a line 4 miles east of Wishram, Washington. The scenic area covers portions of six counties: Clark, Skamania, and Klickitat counties in Washington and Multnomah, Hood River, and Wasco counties in Oregon. Columbia River Gorge National Scenic Area was created in November 1986 when Congress passed the Columbia River Gorge National Scenic Area Act. The USFS manages nine additional recreation areas within the rail corridor study area, of which Gifford Pinchot National Forest and Mt. Hood National Forest provide many recreational opportunities.

The NPS-managed Fort Vancouver National Historic Site is the site of the original Hudson’s Bay Stockade located in Vancouver, Washington (NPS 2015). Recreational activities include visitor tours, cultural demonstrations, and walking paths.

The USFWS manages five wildlife refuges and two fish hatcheries within the rail corridor study area in Washington, including Franz Lake NWR, Pierce NWR, Steigerwald NWR, McNary NWR, Turnbull NWR, Little White Salmon Fish Hatchery, and Spring Creek Fish Hatchery. Franz Lake NWR and Pierce NWR are both closed to the public, and recreational activities are generally limited to wildlife viewing and photography from outside of these refuges. Steigerwald Lake NWR offers wildlife viewing, photography, and hiking. In addition to wildlife viewing and photography, McNary NWR offers visitors hiking, horseback riding, environmental education activities, boating, fishing, and hunting (USFWS 2015a). Turnbull NWR offers hunting, fishing, wildlife observation, photography, environmental education, and interpretation to visitors (USFWS 2015b). An underwater viewing area is available to visitors at Little White Salmon National Fish Hatchery, and Chinook and coho can be seen spawning in the river below the hatchery, particularly in the fall (USFWS 2015c). Recreational opportunities at Spring Creek National Fish Hatchery include picnicking and wildlife viewing (USFWS 2015d).

The USACE manages recreational sites within the in-state rail corridor study area, with 29 designated recreational sites. USACE recreational sites allow visitors biking, hiking, boating, fishing, camping, hunting, and windsurfing options.

Table 3.12-2. Major Designated Recreational Sites in Rail Corridor Study Area in Washington and Oregon

Manager	Park			
Federal				
Bureau of Land Management	• Lower Deschutes River • Mount Hood National Forest			
US Forest Service	• Columbia Gorge Discovery Center • Columbia Gorge National Scenic Area • Gifford Pinchot National Forest	• Klickitat River • Mark O Hatfield Wilderness • Toll House Park	• Wyeth Campground • Sandy River Delta Park • St Cloud Day Use Area • Mount Hood National Forest	
National Park Service	• Fort Vancouver National Historic Site			
US Fish and Wildlife Service	• Franz Lake National Wildlife Refuge • Little White Salmon Fish Hatchery • Pierce National Wildlife Refuge	• Spring Creek Fish Hatchery • Steigerwald Lake National Wildlife Refuge	• McNary National Wildlife Refuge • Turnbull National Wildlife Refuge	
US Army Corps of Engineers	• Avery Recreation Area • Bradford Island Recreation Area • Bradford Island Visitor Center • Cliffs Park • Fort Cascades National Historic Site • Giles French Park • Hamilton Island Recreation Area	• Hess Park • John Day Dam Visitor Center • Lapage Park • McNary Beach • North Shore Recreation Area • Paradise Park • Paterson Park • Phillipi Park	• Plymouth Park • Railroad Island Park • Robin Island Recreation Area • Rock Creek Park • Roosevelt Park • Rufus Landing Recreation Area • Seufert County Park • Spearfish Park	• Sundale Park • Tanner Creek Fishing Area • The Dalles Dam • The Wall • Threemile Canyon Park/Quesnal County Park • Washington Shore Visitors Complex
State				
Oregon Department of Fish and Wildlife	• Irrigon Wildlife Area • Lower Deschutes Wildlife Area	• Willow Creek Wildlife Area		

Table 3.12-2. Major Designated Recreational Sites in Rail Corridor Study Area in Washington and Oregon

Manager	Park
Oregon State Parks	• Ainsworth State Park • Benson State Park • Bonneville State Scenic Corridor • Bridal Veil Falls State Park • Crown Point State Scenic Corridor • Dalton Point State Recreation Site • Deschutes River Recreation Area • Government Island State Recreation Area • Guy W Talbot State Park • Hat Rock State Park • Heritage Landing • Historic Columbia River Highway • John B. Yeon State Scenic Corridor • Koberg Beach State Park • Lang Forest State Park • Lemon Island • Lindsey Creek State Park • Lower Deschutes State Recreation Area • Mayer State Park • McGuire Island Park • McLoughlin State Park • Memaloose State Park • Rooster Rock State Park • Seneca Fouts Memorial State Park • Sheppard's Dell State Natural Area • Sheridan State Scenic Corridor • Starvation Creek State Park • Viento State Park • Vinzenz Lausmann State Park • Wygant State Park
Washington Department of Fish and Wildlife	• Rowland Lake • Sunnyside Wildlife Area Complex- Mesa Lake Unit
Washington Department of Natural Resources	• John Wayne Pioneer Trail
Washington State Department of Transportation	• Chamberlain Lake Rest Area • Sprague Lake Rest Area
Washington State Parks	• Beacon Rock State Park • Centennial Trail State Park • Columbia Hills • Columbia Plateau Trail State Park • Doug's Beach State Park • Government Island • Horsethief Lake State Park • Jane Weber Evergreen Arboretum • Maryhill State Park • Reed Island State Park* • Riverside State Park • Sacajawea Park • Spring Creek Fish Hatchery
Local	
Benton County	• Benton County Fairgrounds • Hover Park • Two Rivers Park
Bingen	• Daubenspeck Park
Boardman Park & Recreation District	• Boardman Park

Table 3.12-2. Major Designated Recreational Sites in Rail Corridor Study Area in Washington and Oregon

Manager	Park
Local (Cont.)	
Camas	• Benton Park* • Camas Community Center • Camas Skate Park • Elizabeth Park • Lacamas Lake Park • Oak Park • Ostensen Canyon Greenway * • Crown Park • Forest Home Park • Goot Park • Louis Block Park
Cheney	• Centennial Park • Hagelin Park • Salnave Park • Sutton Park
City of Arlington	• Earl Snell Memorial Park
City of Spokane	• Ashland & Elliot Park • Cannon Hill Park • Chief Garry • Coeur D'Alene Park • Comstock Park • Cowley Park • Glover Field • Grandview Park • High Bridge Park • John A. Finch Arboretum • Liberty Park • Peaceful Valley Park • Polly Judd Park • Qualchan Hills • Riverfront Park • South Maple • Stone Park • UTF Skate Park • Wentel Grant • White Park
Clark County	• East Biddle Lake* • Lacamas Regional Park • Washougal River Greenway • Captain William Clark
Connell	• Clark Street Park • Heritage Park • Striker Park
Hood River	• Hood River Event Site • Hood River Marina Park • Hood River Water front Park • Rotary Park • The Spit
Hood River County	• Morrison Park • Ruthton Park
Irrigon	• Irrigon Marine Park
Kennewick	• East Gate Park • Kennewick Arboretum • Vietnam Memorial
Klickitat County	• Jewett Creek Park
Mesa	• Poe Park

Table 3.12-2. Major Designated Recreational Sites in Rail Corridor Study Area in Washington and Oregon

Manager	Park
Local (Cont.)	
Metro	• Blue Lake Regional Park • Broughton Beach • Chinook Landing Marine Park • Flag Island • Gary Island
Millwood	• Millwood Park
Northern Wasco County Park and Recreation District	• Lewis & Clark Rock Fort Campsite • The Dalles River Front Park • Thompson City Park
Pasco	• Centennial Park • Highland Park • Mercier Park • Kurtzman Park Martin Luther King Junior Community Center Park • Volunteer Park
Port of Benton	• Crow Butte Park
Port of Camas-Washougal	• Port of Camas-Washougal Marina
Port of Cascade Locks	• Cascade Locks Marine Park
Port of Hood River	• Island Parkland (undeveloped) • The Hook
Port of Klickitat	• Bingen Marina Park • Sailboard Park
Port of Skamania County	• Beacon Rock Golf Course • Bob's Beach • Cascade Boat Launch • East Point • Leavens Point • Pebble Beach • Stevenson Landing • Teo Park
Port of Vancouver	• Vancouver Landing
Portland	• East Delta Park • Heron Lake Golf Course • Kelley Point Park
Skamania County	• Home Valley Park • Rock Creek Fairgrounds
Spokane County	• Fish Lake Regional Park • High Drive Conservation Area • Interstate Fairgrounds • Latah Creek • Plantes Ferry Park

Table 3.12-2. Major Designated Recreational Sites in Rail Corridor Study Area in Washington and Oregon

Manager	Park			
Local (Cont.)				
Spokane Valley	• Knox Park	• Mirabeau Meadows		
The Dalles	• Lewis & Clark Festival Park			
Umatilla	• Umatilla Marina Park			
Vancouver	• Behrens Woods (undeveloped) • Biddlewood Open Space • Biddlewood Park • Dubois Park/Blandford Greenway • Edgewood/Harney Elementary School Park • Ellsworth Springs	• Ellsworth Springs East (undeveloped) • Ellsworth Springs West (undeveloped) • Esther Short Park • Father Blanchet Park • Fisher's Creek	• Fisher's Landing* • General Anderson Park • Hambleton Park* • Henry J. Biddle Nature Preserve* • Lieser Point* • Marine Park	• Mimsi Marsh* • Old Apple Tree Park • Southcliff/Blandford Greenway West • Waterfront • Wildwood Park • Wintler Park
Washougal	• Angelo Park • Beaver Park • George F. Schmidt • Hamilick Park	• Hathaway Park • Mabel Kerr • Main Street Pocket Park • Reflection Plaza	• Riverbend Park • Sandy Swimming Hole • Steamboat Landing Park • Stevenson Dog Park	
White Salmon	• City Pool • Fireman's Park	• Rheingarten Park • The Little City Park		
Private/Other				
	• Big River Golf Course • Bridges Middle School Fields • Columbia Edgewater Country Club • Fairway Village	• Four Seasons Campground • Hough Aquatic Center* • Lotus Isle Park • Orchard Hills Golf & Country Club	• Skamania Lodge Golf Course • Sundial Beach	

*undeveloped park

Oregon State Parks and Recreation manages 30 major recreational sites/recreation areas within the rail corridor study area, while Washington State Parks and Recreation manages 13 major recreational sites. ODFW also manages three wildlife areas that offer recreational activities to the public, including Irrigon Wildlife Area, Lower Deschutes Wildlife Area, and Willow Creek Wildlife Area. WDFW manages the Mesa Lake Unit of Sunnyside-Snake River Wildlife Area Complex and offers fishing recreation to visitors (WDFW 2006).

Furthermore, an estimated 155 developed and planned city, county, and private recreational sites are located within the rail corridor study area.[2] They include recreational sites such as neighborhood parks, designated open space, and private recreational facilities such as golf courses.

The rail corridor study area outside of Washington would travel through or in close proximity to numerous parks and recreation areas including Kootenai National Forest (USFS), Stillwater State Forest (NPS), and Glacier National Park (NPS) in Montana.

Trails

Three National Trails are located within the rail corridor study area in Washington and Oregon: Pacific Crest National Scenic Trail, Lewis and Clark National Historic Trail, and Ice Age Floods National Geologic Trail. Pacific Crest National Scenic Trail travels 2,650 miles from the Mexico-US border to the Canada-US border. Pacific Crest National Scenic Trail is grade separated from the rail corridor and crosses over the rail corridor at the Bridge of the Gods near Stevenson, Washington.

Portions of the Lower Columbia River Water Trail and the Lewis and Clark Trail are located within the proposed Facility study area and segments of both trails are also located in the rail corridor study area. Lower Columbia River Water Trail provides recreational users with access to public launch and landing sites, camping, and sites of interest. Portions of the Washington State Designated Lewis and Clark Auto Tour Route, an interpretive tour route that is part of the Lewis and Clark Trail, are located within the rail corridor study area; including US Highway 12, SR 124, US Highway 395 and I-82 within the proximity of the Tri-cities (Washington State Agency Assistance Team 2001). The auto route then follows Highway 14 from US 395 west to I-5. The rail corridor crosses under the driving tour route at US 395 in Pasco, Washington.

Ice Age Floods National Geologic Trail was established by Congress in 2009, under Public Law 111-11. The trail is currently under development, but it will primarily be an auto route with interpretive signage covering the channeled scablands of eastern Washington, the Columbia Gorge, and portions of Idaho, Montana, and Oregon that were affected by the Missoula floods (Lake Roosevelt Forum Newsletter 2014). The proposed main route for the Ice Age Floods National Geologic Trail follows I-90 in the proximity of Spokane, is grade separated from the rail corridor where it would cross in the vicinity of Lind, and follows I-84 in Oregon and Washington SR 14 (NPS 2001). At this preliminary planning stage it appears the trail's main route will be grade separated from the rail line.

Columbia Plateau Trail State Park is a 130-mile-long trail that was originally the railbed for the Spokane, Portland, and Seattle Railroad. The trail is approved for multiple user groups, including horseback riding, ADA hiking, bike, cross-country skiing, and snowshoeing. The route is most accessible at Cheney, with other less accessible points along the trail (Washington State Parks 2015). The trail is located within the

2 Planned recreational sites are included in this discussion to address all potential impacts on recreation from trains associated with the proposed Facility. Some of the recreation areas may be developed following the Record of Decision but before the completion of construction.

rail corridor study area in the vicinity of Cheney, Washington. At-grade crossing is required to access the Columbia Plateau Trail head along Cheney Spangle Road in Cheney, Washington.

John Wayne Pioneer Trail is a 250-mile-long trail, which is located within the rail corridor study area in the vicinity of Lind, Washington. The trail is approved for multiple user groups, including horseback riding, hiking, bike, cross-country skiing, and snowshoeing. The WDNR manages the trail segment located within this study area. The trail is grade separated from the rail corridor at the intersect location.

The USFS-managed Klickitat Rail Trail is a nonmotorized multiuse trail that begins at Lyle Trailhead off Washington State Highway 14 near Lyle and ends at Klickitat, Washington. The trail is managed for hiking, mountain biking, and horseback riding. It continues another 18 miles to near Centerville, Washington under Washington State Parks jurisdiction (USFS 2015). The trail head is located adjacent to the rail corridor and they do not intersect one another.

Spokane River Centennial Trail State Park is a 37-mile-long paved recreational trail for pedestrians and nonmotorized vehicles (Spokane County 2015). The trail stretches from Sontag Park in Nine Mile Falls, Washington, to the Washington/Idaho stateline. The rail corridor crosses the trail at a grade-separated crossing in Spokane Valley, Washington.

The rail corridor crosses Fish Lake Trail in Spokane near the intersection of Highway 195 and I-90, then again in the vicinity of Marshall, Washington. Currently, the trail ends within the rail corridor study area at Scribner Road south of Marshall. Future plans call for the construction of a bridge over the rail corridor to complete the remaining 2.5 miles of the trail and connect to Fish Lake Park (City of Spokane 2015). This trail is grade separated at each location where it crosses the rail corridor.

Cascade Locks International Mountain Bike (CLIMB) Trail is built on land owned by the Port of Cascade Locks. The 2-mile mountain bike trail loop is located within the Port of Cascade's Industrial Park (Port of Cascade Locks 2012). The CLIMB trail is located in Oregon and does not intersect the rail corridor.

Waterfront Renaissance Trail connects Esther Short Park in downtown Vancouver to Wintler Park and passes through Marine Park along a paved 5-mile-long trail (City of Vancouver 2015b). In 2010, the trail was estimated to have nearly 1 million annual users in the vicinity of Fort Vancouver (City of Vancouver 2015b). The rail corridor crosses the trail at three grade-separated locations.

Marine Drive Trail connects Kelley Point Park to Blue Lake Regional Park along Marine Drive in north Portland (Metro 2014). A portion of this trail is also located within the proposed Facility study area. The Marine Drive Trail is located in Oregon and does not intersect the rail corridor.

Hunting

WDFW and ODFW regulate hunting within the rail corridor study area. Hunting in Mt Hood National Forest and Gifford Pinchot National Forest is permitted during the open season. Hunting is not permitted at the three Gorge NWRs: Steigerwald, Franz Lake, and Pierce (USFWS 2006), while hunting within McNary NWR is permitted for goose, duck, coot, dove, snipe, and upland game birds (USFWS 2014). Hunting is permitted within Irrigon Wildlife Area and Willow Creek Wildlife Area. Target species include California quail, duck, geese, mourning dove, and deer. Hunting is allowed within Deschutes Wildlife Area; however, the area located specifically within the rail corridor study area is closed to hunting (WDFW 2015c). During special seasons, controlled quality limited entry elk and youth waterfowl hunting is allowed at Turnbull NWR (USFWS 2015e). Hunting is not permitted within Klickitat Wildlife Area Complex – Sondino Pond Unit, which is primarily used as western pond turtle habitat (WDFW 2015d).

Water-Based Recreation

The rail corridor study area includes many waterbodies both within and outside of Washington. Existing water-based recreational use likely occurs on or near many of these waterbodies.

The portions of the Deschutes and Klickitat rivers located in the rail corridor study area within Washington and Oregon are designated as National Wild and Scenic Rivers and are classified as recreational rivers. Also, segments of the John Day, Sandy, and White Salmon rivers are designated as National Wild and Scenic Rivers; however, the segments of these rivers located within this study area are not included in the designation (BLM 2015).

Ecology (WAC 173-201A-602) classifies waterbodies into three recreational use categories: Extraordinary Primary Contact Recreation, Primary Contact Recreation, and Secondary Contact Recreation. No Extraordinary Primary Contact Recreation waterbodies occur in the rail corridor study area. The Primary and Secondary Contact Recreation waterbodies within the study area, as identified by the State of Washington, include the following rivers and streams (WAC 173-201A-602):

- Carson Creek
- Catherine Creek
- Columbia River
- Duncan Creek
- Greenleaf Creek
- Hamilton Creek
- Hardy Creek
- Jewett Creek
- Klickitat River
- Little White Salmon River
- Major Creek
- Rock Creek
- Snake River
- Spokane River
- Walla Walla River (secondary)
- Washougal River
- White Salmon River
- Wind River
- Woodward Creek

Outside of Washington, the rail line travels in close proximity to many waterbodies with water-based recreational opportunities, most notably Lake Pend Oreille in Idaho and Whitefish Lake in Montana.

Boating

Oregon State Marine Board conducts a survey of registered Oregon boat owners every 3 years, which provides information on boating use for waterbodies throughout the state including the Columbia River. Oregon State Marine Board estimates that the portion of the Columbia River located within Oregon had a total of 383,000 boating activity days in 2010 (Oregon State Marine Board 2010). It is estimated that of these total activity days 232,000 were related to fishing, 30,100 were for sailing, 9,200 were for personal watercraft, 12,500 were for waterskiing, 91,100 were for cruising, and 8,100 were for hunting recreation (Oregon State Marine Board 2010).

Numerous boating facilities have been constructed within the rail corridor study area to support water-based recreational activities, including water access, launches, marinas, and moorage facilities. Table 3.12-3 lists the major boating facilities within the rail corridor study area within Washington and Oregon, most of which are associated with the Columbia River.

Table 3.12-3. Major Boating Facilities in the Rail Corridor Study Area in Washington and Oregon

Manager	Facility
Federal	
US Army Corps of Engineers	• Avery Boat Ramp • Celilo Park • Fort Cascades Boat Ramp • Giles French Park • Le Page Park • McNary Dam • North McNary • Pasco Boat Basin • Plymouth Park • Railroad Island Boat Ramp • Rock Creek • Roosevelt Park • Spearfish Park Ramp • Sundale Park • The Dalles Dam and Lock Boat Ramp • Three Mile Canyon Park
US Fish and Wildlife Service	• Casey Pond Boat Launch • Madame Dorion Memorial Park • Paterson Ramp
State	
Oregon State Parks	• Bartlett's Landing • Dalton Point • Hat Rock State Park • Government Island Landing • Heritage Landing State Park • Mayer State Park Launch • Rooster Rock State Park
Washington State Parks	• Beacon Rock State Park Ramp • Crow Butte Ramp • Horsethief State Park • Maryhill State Park Ramp • Sacajawea State Park Launch
Washington Department of Fish and Wildlife	• Rowland Lake
Local	
Benton County	• Two Rivers Boat Launch
Boardman Park and Recreation	• Boardman Park
City of Umatilla	• Nugent Park
Irrigon Parks and Recreation District	• Irrigon Marina
Klickitat County	• Lyle Ramp
Metro	• Chinook Landing Boat Ramp • M. James Gleason Ramp
Port of Arlington	• Arlington Marina
Port of Camas-Washougal	• Port of Camas-Washougal Marina
Port of Cascade Locks	• Cascade Locks Marina
Port of Hood River	• Hood River Marina
Port of Kennewick	• Clover Island Marina
Port of Klickitat	• Bingen Marina
Port of Skamania	• Cascade Boat Ramp
Port of the Dalles	• Port of the Dalles Marina
Port of Umatilla	• Umatilla Marina
Skamania County	• Drano Lake Launch • Wind River Launch

Table 3.12-3. Major Boating Facilities in the Rail Corridor Study Area in Washington and Oregon

Manager	Facility			
Spokane County Parks & Rec	• Plantes Ferry Park			
Vancouver	• Marine Park Ramp	• Vancouver Landing		
Private				
	• Cascade Pacific Sea Scout Base Dock • Columbia Corinthian Marina • Columbia Marina • Columbia Ridge Marina • Columbia River Yacht Club • Donaldson Marina • Fishery Boat Ramp	• Four Seasons Campground Launch • Four Seasons Launch • Harbor 1 • Hayden Bay Moorage • Jantzen Bay Moorage/ Fuel Dock • McCuddy's Marina • McCuddy's Marine Drive Moorage	• McNary Yacht Club • Metz Marina • Pac Mar • Pier 99 Marina • Portland Yacht Club • Rose City Yacht Club • Salpare Bay Marina • Sprague Lake Launch • Sprague Lake Resort	• Steamboat Landing Park • Sundance Moorage • Tomahawk Bay Moorage • Tyee Yacht Club • Walla Walla Yacht Club

Recreational Fishing

The Columbia River receives a high volume of fishing activity. It is estimated that over the 2002-2009 period, an average of 156,200 annual fishing trips for Chinook, coho, and steelhead occurred within the mainstem of the Columbia River from Bonneville Dam to the Highway 395 Bridge in Pasco/Kennewick. Furthermore, it is estimated that over the 2002-2009 period, an average of 350,880 annual fishing trips for these same species occurred in the Columbia River mainstem from Buoy 10 to Bonneville Dam (Table 3.12-4). In total, an average of 507,080 annual Chinook, coho, and steelhead fishing trips were taken within the mainstem over the 2002-2009 period from the Columbia River mouth to the Highway 395 Bridge in Pasco/Kennewick, Washington.

From the I-5 Bridge in Vancouver to Bonneville Dam, steelhead fishing season is from January 1 to March 31 and June 16 to December 31 (ODFW 2015b). The spring Chinook fishery for this section of the Columbia River is from March to April and, depending on fishery management decisions, could extend into June (ODFW 2014). The fall Chinook and coho season is from August 1 to December 31. Additional regulations cover closures and method of take within this segment of the Columbia River, such as closures near specific tributaries and shoreline fishing restrictions. Retention of caught white sturgeon is prohibited within this management area.

From Bonneville Dam upstream to the Oregon-Washington border above McNary Dam, steelhead fishing season is from January 1 to March 31 and June 16 to December 31. The spring Chinook fishery for this section of the Columbia River is from March to May (ODFW 2015a) and depending on fishery management decisions, could extend into June (ODFW 2014). The fall Chinook and coho season for this section of the Columbia is from August 1 to December 31. Retention of caught white sturgeon is permitted from Bonneville Dam to McNary Dam from January 1 until the quota is reached, and retention is permitted from February 1 through July 31 from McNary Dam to the Oregon-Washington border.

Other major fishing streams along the rail corridor within Washington and Oregon include the Spokane River and the confluence of numerous rivers where they intersect the Columbia River. Major fishing tributaries to the Columbia River include the Snake River, John Day River, Deschutes River, Klickitat River, White Salmon River, Little White Salmon River, Wind River, Sandy River, and Washougal River.

Table 3.12-4. Lower Columbia and Mid-Columbia River Annual Recreational Fishing Trips

	2002	2003	2004	2005	2006	2007	2008	2009	Annual Average
Lower Columbia River Mainstem (Buoy 10 to Bonneville Dam)									
Chinook Salmon	308,650	299,620	287,020	196,420	130,570	99,200	199,680	193,720	214,360
Coho Salmon	38,400	231,600	68,510	31,100	20,230	38,490	45,090	217,150	86,320
Steelhead	62,630	50,530	46,320	38,950	53,160	56,320	47,890	45,790	50,200
Total	409,680	581,750	401,840	266,460	203,960	194,010	292,660	456,660	350,880
Mid-Columbia River Mainstem (Bonneville Dam to McNary Dam, and McNary Dam to Highway 395 bridge)									
Chinook Salmon	22,150	28,990	24,690	20,510	17,990	20,320	30,440	19,950	23,130
Coho Salmon	NA	NA	NA	NA	NA	NA	NA	NA	32,980
Steelhead	145,690	97,990	70,050	79,530	106,830	100,450	NA	NA	100,090
Total	167,840	126,980	94,740	100,040	124,820	120,760	30,440	19,950	156,200

Source: Adapted from NOAA 2014.

Note: Historical catch estimates were used in conjunction with the average fishing effort, ranging from 4.2 fishing days per fish caught for coho salmon to 5.3 fishing days per fish caught for steelhead.

NA = not available

3.12.2.3 Vessel Corridor

Parks and Recreation Areas

The Columbia River vessel corridor study area includes multiple formal designated recreational sites and informal open-space areas used for recreation. These areas include state and local parks, state and federal public lands, and waterbodies (Table 3.12-5). Appendix E.6 shows the location of the major recreation areas in this study area.

The federal agencies managing major recreational sites within the Columbia River vessel corridor study area include the NPS (1 site) and USFWS (4 sites). The NPS-managed Lewis and Clark National Historic Park is the site of where the Lewis and Clark expedition camped during the winter of 1805 (NPS 2015). Recreational activities include visitor tours, cultural demonstrations, and walking paths.

The USFWS manages three wildlife refuges within the Columbia River vessel corridor study area, including Julia Butler Hansen NWR, Lewis & Clark NWR, and Ridgefield NWR. Recreational activities for Julia Butler Hansen NWR include wildlife viewing, photography, fishing, hunting, boating, interpretation, environmental education, and other events (USFWS 2015f). Recreational activities at Lewis & Clark NWR include fishing, hunting, photography, and wildlife observation (USFWS 2015g). Recreational activities at Ridgefield NWR include an auto tour route, trails, interpretation, naturalist-led hikes, waterfowl hunting, fishing, and wildlife viewing (USFWS 2015h).

Oregon State Parks and Recreation manages two major recreation areas within the Columbia River vessel corridor study area (Bradley State Scenic Viewpoint and Fort Stevens State Park), while Washington State Parks and Recreation manages Cape Disappointment State Park and Fort Columbia State Park. Within the Columbia River vessel corridor study area, ODFW manages Sauvie Island Wildlife Management Area and WDFW manages both the Puget Island Access site and Shillapoo Wildlife Area (WDFW 2006). Oregon Department of Forestry manages Clatsop State Forest and offers visitors camping, hunting, fishing, and off-highway use (Oregon Department of Forestry 2015). Oregon State

Land Board and Department of State Lands manage Dibble Point, a popular fishing area, and Jones Beach, a popular kite boarding location.

In addition to these federal and state recreational sites an estimated 31 city, county, and private recreational sites are located within the Columbia River vessel corridor study area. They include recreational sites such as neighborhood parks, designated open space, and private recreational facilities such as Trojan Park.

Table 3.12-5. Major Designated Recreational Sites in the Columbia River Vessel Corridor Study Area

Manager	Park/Resource
Federal	
US Fish and Wildlife Service	• Julia Butler Hansen National Wildlife Refuge • Lewis & Clark National Wildlife Refuge • Ridgefield National Wildlife Refuge
National Park Service	• Lewis and Clark National Historic Park
State	
Oregon Department of Fish and Wildlife	• Sauvie Island Management Area
Oregon Department of Forestry	• Clatsop State Forest
Oregon State Land Board and Department of State Lands	• Dibblee Point • Jones Beach
Oregon State Parks	• Bradley State Scenic Viewpoint • Fort Stevens State Park
Washington Department of Fish and Wildlife	• Puget Island Access Site • Shillapoo Wildlife Area
Washington Department of Transportation	• Dismal Nitch Rest Area
Washington State Parks	• Cape Disappointment State Park • Fort Columbia State Park
Local	
Astoria Parks and Recreation	• Alderbrook Park • Astoria Riverwalk • Birch Field • Children's Park • Columbia Field • Fort Astoria • LaPlant Park • Portal Park • Tapiola Park
City of Rainier	• Rainier City Park
City of St. Helens	• Columbia Botanical Gardens • Columbia View Park • Godfrey Park • Grey Cliffs Waterfront Park • Sand Island Marine Park
City of Warrenton	• Seafarer's Park
Clark County	• Frenchmen's Bar Park
Clatsop County	• Twilight Eagle Sanctuary
Columbia City	• Jim Bundy Memorial Park • Laurel Beach County Park • Prescott Beach Park
Cowlitz County	• Willow Grove Park
Multnomah County	• Bellevue County Park*
Port of Kalama	• Marine Park and Louis Rasmussen Day Use Park

Table 3.12-5. Major Designated Recreational Sites in the Columbia River Vessel Corridor Study Area

Manager	Park/Resource	
Port of Wahkiakum No. 2	• Skamokawa Vista Park	
Port of Woodland	• Austin Point	• Martins Bar
Town of Cathlamet	• Erickson Park	• Strong Park
Wahkiakum County	• County Line Park	
Private		
	• Trojan Park	

*undeveloped park

Trails

Portions of both the Lewis and Clark Trail and the Lower Columbia River Water Trail are located within the Columbia River vessel corridor study area as well as the proposed Facility and rail corridor study areas. The Lower Columbia River Water Trail provides recreational users with access to public launch and landing sites, camping, and sites of interest.

No trails are located in areas farther than 3 nmi beyond the Columbia River mouth.

Hunting

Hunting geese, ducks, coot, and snipe is permitted along the shoreline of the Julia Butler Hansen NWR portion of Hunting and Wallace Island in accordance with federal, Washington, and Oregon hunting regulations (USFWS 2015f). Most of Lewis & Clark NWR is open to hunting for geese, ducks, coots, and snipe in accordance with Oregon and federal regulations (USFWS 2015g). A portion of Ridgefield NWR River "S" Unit is open to waterfowl hunting; however, the unit is not located within the Columbia River vessel corridor study area (USFWS 2015h). Hunting is permitted within Shillapoo Wildlife Area. The ODFW-managed Sauvie Island Management Area is a major waterfowl hunting area (ODFW 2012). Hunting is permitted in Clatsop State Forest with most of the hunting effort concentrated upon deer and elk (Oregon Department of Forestry 2001).

No hunting occurs in areas farther than 3 nmi beyond the Columbia River mouth.

Water-Based Recreation

The Columbia River vessel corridor study area includes many waterbodies in Washington and Oregon. No Extraordinary Primary Contact Recreation or Secondary Contact Recreation waterbodies occur in the Columbia River vessel corridor study area, whereas Primary Contact Recreation waterbodies identified within the study area include (WAC 173-201A-602):

- Columbia River
- Cowlitz River
- Elochoman River
- Mill Creek

An Oregon State Marine Board (2010) survey of registered Oregon boat owners estimated that the portion of the Columbia River located within Oregon had a total of 383,000 boating activity days in 2010 (Oregon State Marine Board 2010). Numerous boating facilities have been constructed to support water-based recreational activities, including water access, launches, marinas, and moorage facilities (Table 3.12-6).

Water-based recreation occurs in areas farther than 3 nmi beyond the Columbia River mouth into the Pacific Ocean including motorized boating, sailing, and fishing.

Boating

Recreational boating within the Columbia River vessel corridor study area is common given the proximity of numerous marinas and boat launches. They include facilities operated by state and local governments as well as private yacht clubs (Table 3.12-6).

Table 3.12-6. Major Boating Facilities in the Columbia River Vessel Corridor Study Area

Manager	Facility	
State		
Washington State Parks	• Fort Canby State Park Ramp	
Washington Department of Fish and Wildlife	• Knappton Access Site • Sportsman Club Ramp	• Sportsman Loop Lower Kalama Ramp • Woodland Bottoms Access Site Launch
Local		
City of Cathlamet	• Cathlamet Public Dock	
City of Rainier	• City of Rainer Marina	• Rainier Riverfront Park Ramp
City of St Helens	• Sand Island Marine Park Moorage	• St Helens Courthouse Docks
City of Warrenton	• Hammond Basin Marina	• Warrenton Marina
Clatsop County	• Aldrich Point Boat Ramp • John Day Boat Ramp	• Westport Boat Ramp • Young's Bay Yacht Club Marina
Cowlitz County	• Willow Grove Ramp	
Longview Parks and Recreation	• Gerhart Gardens Park Ramp	
Port of Astoria	• Astoria East Basin Marina	• Astoria West Basin Marina
Port of Cathlamet	• Port of Cathlamet Boat Ramp #2	
Port of Chinook	• Port of Chinook	
Port of Ilwaco	• Port of Ilwaco	
Port of Kalama	• Port of Kalama Marina	
Port of Wahkiakum County No. 1	• Elochoman Slough Marina	
Port of Wahkiakum County No. 2	• Skamakowa Ramp	
Private		
	• Portland Yacht Club-Willow Bar Outstation • Columbia River Yacht Club Outstation • Goble Marina • Kadow's Marina	• Longview Yacht Club • Marina at Skipanon • St Helens Marina

Recreational Fishing

The numerous boat launches in marinas (Table 3.12-6) support a high volume of fishing activity on the Columbia River. It is estimated that over the 2002-2009 period, an average of 350,880 annual fishing trips for Chinook, coho, and steelhead occurred within the mainstem of the Columbia River from Buoy 10 to Bonneville Dam (NOAA 2014). The Buoy 10 fishery at the Columbia River mouth is a popular fall Chinook salmon fishery, which begins on August 1 and lasts for approximately a month, then again from October 1 through December 31. It is also popular for coho fishery and opens on August 1 and depending on management decisions can last until December 31 (WDFW 2014b). Given the popularity of the fishery, the USCG Auxiliary – Buoy 10 Task Force distributes safety information to boaters in the Astoria area during the Buoy 10 fishing season in an effort to educate them regarding the dangers of fishing in the area due to the presence of large commercial vessels (USCG 2015).

Recreational fishing occurs beyond the 3-nmi boundary at the Columbia River mouth into the Pacific Ocean as private fishing boats and charters. Important species regularly caught in this area are Pacific halibut, coho and Chinook salmon, albacore tuna, lingcod, and black rockfish[3] (ODFW 2015c).

3.12.3 Impact Assessment

3.12.3.1 Proposed Facility

Construction

Construction of the proposed Facility is not anticipated to have any long-term direct or indirect impacts to current or planned park and recreation areas. The development would occur entirely within industrial-designated lands zoned for high-intensity development that are not designated or used for recreational purposes.

Temporary access-related impacts have the potential to occur to users of recreation areas located northwest of the proposed Facility site off of NW Lower River Road (i.e., Vancouver Lake Park, Frenchman's Bar, and the Shillapoo site). However, as described in Section 3.14.3.1, roadway traffic impacts due to Project construction are not expected to create noticeable delays, resulting in minor impacts to access to nearby recreation areas.

Construction of the proposed Facility marine terminal may add congestion within the Columbia River adjacent to the Facility; however, it is expected that in-water construction impacts to marine traffic would be negligible (see Section 3.14.3.1).

Moderate noise impacts and slightly perceptible ground vibration could occur within areas in close proximity to the proposed Facility during construction. Shillapoo Wildlife Area – Vancouver Unit is located approximately 1,200 feet from the Facility. As provided in Table 3.9-12, the existing sound levels for numerous receptors near the Facility were measured. Based upon the existing SLM) of 60 dBA for receptor R5, the SLM in Shillapoo Wildlife Area can be assumed to be 60 dBA. As described in Section 3.9.2, this SLM is representative of fairly remote locations, far from continuous noise sources, with occasional events due to trains passing by or activities. An assumed increase of 3 dBA to a noise level of 63 dBA is conservatively expected at Shillapoo, which would be just noticeable to human perception. This noise impact would only occur during construction hours and would be limited to the duration of construction. Impact pile-driving activities would occur during the EFSEC modified in-water work window (September 1 to January 15), which would coincide with periods within hunting seasons for goose (in Goose Management Area 2A; November 8 to 30 and December 10 to January 25), duck (September 20 and 21, October 11 to 15, and October 18 to January 25), and pheasant (September 20 to

3 Anglers are encouraged to avoid canary rockfish due to an annual quota (WDFW 2015e)

November 30) (WDFW 2014a). However, pile driving would not occur all day or every day during the in-water work window. Construction noise from impact pile driving on hunters and other recreationists at the area is expected to be minor for those areas of Shillapoo Wildlife Area – Vancouver Unit closest to the proposed Facility, while noise impacts are not expected for other areas of the unit located at a greater distance from the proposed Facility.

During construction, minor changes to the visual setting near the proposed Facility would occur from the presence of construction workers, equipment vehicles, and partially constructed structures. However, it is expected this visual impact upon recreational resources within the proposed Facility study area would be minor and temporary, lasting for the duration of construction.

Operations and Maintenance

No long-term impacts are anticipated to recreational facilities as a result of Facility operations and maintenance. Recreational sites would not be directly impacted because the proposed Facility would be constructed entirely on land designated as industrial and would not result in the conversion of any current or planned park land to nonpark uses.

Although use of roadways near the proposed Facility would increase from operation and maintenance staff, such traffic would not result in any change in roadway level of service, so recreationists traveling along NW Lower River Road would not be impacted. The use of Berth 13 is expected to result in minor impacts to vessel traffic in the vicinity of the proposed Facility marine terminal (see Section 3.14.3.1), so impacts to recreationists using this area of the Columbia River may experience minor impacts from increased traffic during operation. Changes in the quality of recreation due to odors or noise may be experienced by some recreationists; however, since the area has been historically used for docking similar types of vessels, this impact is anticipated to be minor.

The scenic quality of an area is often important to recreationists; however, the proposed Facility is consistent with the existing industrial character and scenic quality currently experienced by recreationists. As discussed in Section 3.11.1, visual simulations were conducted for nearby areas with recreational use (see Figure 3.11-1 showing the locations of the KOPs). Simulations were developed for the appearance of the Facility from Franklin Park and for NW Lower River Road, which serves as access points for recreationists accessing Vancouver Lake, Frenchmen’s Bar Park, the Columbia River, and Shillapoo Wildlife Area. Visual simulations were also conducted for a KOP within the Columbia River, directly opposite from the Facility, which would be accessible to recreational boaters. Visual impacts at each of these KOPs are expected to be minor.

Decommissioning

Impacts resulting from decommissioning activities are expected to be similar in nature to the impacts of Facility construction except that no impact pile driving is anticipated. Impacts to recreational resources from decommissioning activities are, therefore, expected to be minor and temporary, lasting for the duration of decommissioning.

3.12.3.2 Rail Transportation

Users of recreational facilities and activities near rail lines that would be used for unit trains associated with the proposed Facility would be exposed to additional rail traffic. Noise impacts from trains associated with the proposed Facility are anticipated to be minor to receptors located along the rail lines (Section 3.9.3.2), which would include recreationists. As discussed in Section 3.2.3.2, no adverse air quality impacts from emissions of criteria air pollutants from train operations are anticipated. Visual impacts to recreation areas would be greatest in highly scenic areas such as the Columbia River Gorge, where the increased number of trains (an average of four unit trains per day) would be visible from scenic viewpoints and recreation areas. However, since trains are currently part of the visual setting of the area, visual impacts from additional trains associated with the proposed Facility would result in an increase in the frequency and the length of time that trains would be running and in view, but would not add a new type of impact to the existing rail corridor (see Section 3.11.3.2).

Some recreational sites are accessed by existing at-grade crossings. For example, Wintler Park in the City of Vancouver is accessed from SE Beach Drive by an existing at-grade crossing of the rail corridor. Access to the site would be blocked during the time a train is passing or is stopped at the crossing. In addition to Wintler Park, 19 other recreation areas within the rail corridor study area are expected to experience delays from passing trains associated with the proposed Facility. Table 3.12-7 identifies those park and recreation areas within the rail corridor study area that require visitors to cross an at-grade intersection to enter a recreation area. Recreational sites that have alternative access not requiring at-grade crossing of the rail corridor would not be affected and have been excluded.

Table 3.12-7. Rail Corridor Recreational Sites with At-Grade Access

Manager	Park
US Forest Service	• St Cloud Day Use Area
US Fish and Wildlife Service	• Turnbull National Wildlife Refuge
US Army Corps of Engineers	• Avery Recreation Area
Washington Department of Fish and Wildlife	• Sunnyside Wildlife Area Complex- Mesa Lake Unit*
Washington State Parks	• Columbia Plateau Trail State Park, Cheney Trailhead • Doug's Beach State Park
Benton County	• Hover Park
Port of Klickitat	• Bingen Marina Park • Sailboard Park
Port of Skamania County	• Bob's Beach • Cascade Boat Launch • East Point • Leavens Point • Pebble Beach • Stevenson Landing • Teo Park
Skamania County	• Home Valley Park
Vancouver	• Lieser Point* • Wintler Park
Private	• Four Seasons Campground

Note:

*Sunnyside Wildlife Area Complex - Mesa Lake Unit could be accessed by an alternative route that would not require crossing a Project-related at-grade intersection. However, this recreational site is included here given the likelihood visitors traveling east on Sheffield Road from Mesa, Washington, would access the site.

As described in Section 3.14.2.2, the average delay for an individual vehicle for a single train would be approximately 2 minutes 30 seconds. Therefore, it is assumed that visitors to the recreational sites identified in Table 3.12-7 could experience an average delay of this same magnitude in the event that they attempted to cross the at-grade crossing at the time a train was passing. A delay of this magnitude is considered a minor impact to recreational sites.

Outside of Washington, impacts to recreational resources would be similar to those inside the state including minor increases in noise, visual effects, and access delays to recreation areas. Air quality impacts include a minor increase in air emissions to Class I Wilderness Areas close to the rail route (e.g., Glacier National Park), which would result in minor impacts to recreationists using these areas.

3.12.3.3 Vessel Transportation

During operations, vessels serving the proposed Facility would use the existing Columbia River Navigation Channel, which would result in an increase in Columbia River vessel traffic. Noise from transiting vessels may or may not be perceptible to recreationists in the area depending on existing noise levels at their location (including recreational boaters motorized boat noise). Existing noise emissions from vessel traffic of the types that would transport oil from the proposed Facility are already part of the noise background. Therefore, impacts to recreational resources from noise within the vessel corridor study area are anticipated to be minor. As described in Section 3.11.3.3, vessels of the size and type that would be used at the proposed Facility are currently part of the visual setting of the area. Visual impacts to recreationists from additional vessels associated with the proposed Facility would be an increase in the frequency and length of time viewers see vessel traffic, resulting in minor impacts.

Seasonal commercial/recreational fishing vessel conflicts occur in certain areas (WorleyParsons 2014). Recreational vessels may be required to give way[4] more often to vessels associated with the proposed Facility, but this impact is anticipated to be minor because only one vessel (two trips) per day would transit the Columbia River.

Beyond the 3-nmi state boundary into the Pacific Ocean, only recreational fishing and boating occurs. The increase of one vessel (two trips) per day in this area would not likely be noticeable in the vast area of open ocean. Impacts to recreation beyond the 3-nmi state boundary would be negligible.

3.12.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to recreation from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to recreation beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Such a facility constructed on the same site would likely impact recreational resources in much the same way as described for the proposed Facility.

3.12.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to recreational resources in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce impacts to recreational resources:

- Distribute the proposed schedule of construction activities to all potentially affected recreational sites within the proposed Facility study area so recreational users are aware of construction-related disruptions and can schedule activities accordingly to avoid disruption.
- Schedule quiet times (breaks in impact driving construction activities) to occur during some periods that correspond to hunting seasons at Shillapoo Wildlife Area – Vancouver Unit and make hunters aware of these quiet times.

4 Under Rule 9 of the International and Inland Rule of the Road, all vessels less than 66 feet, vessels engaged in fishing, and sailing vessels cannot impede the passage of the vessel that can only operate safely in the channel.

- Provide financial support for existing boater educational efforts being conducted by organizations such as USCG Auxiliary – Buoy 10 Task Force and the numerous sheriff department marine patrols along the vessel corridor to help avoid potential commercial vessel/recreational boat conflicts during peak fishing seasons.

3.12.6 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to recreational resources have been identified.

3.13 HISTORIC AND CULTURAL RESOURCES

Cultural resources include the locations of human activity, occupation, or usage that contain materials, structures, or landscapes that were used, built, or modified by people. They also include the institutions that form and maintain communities and link them to their surroundings. Cultural resources consist of archaeological resources (e.g., sites and isolated finds), historic buildings and structures, and properties of religious and cultural significance, including Traditional Cultural Properties (TCPs). Reserved Treaty Rights are also included in this discussion of cultural resources. These treaty rights reserve tribal access to usual and accustomed (U&A) places for hunting, fishing, and gathering within lands that were formally ceded by the tribes to the United States, lands explicitly named in their respective treaties, and in areas that have been used and occupied for extended periods of time. For the purposes of this discussion, all of these resources are referred to collectively as “cultural resources.”

Cultural Resources Terminology and Descriptors

Cultural resources can occur within “districts,” which are discrete geographic areas containing a significant concentration, linkage, or continuity of sites, buildings, structures, or objects that are united by past events or aesthetically by plan or physical development. Archaeological resources are characterized temporally as precontact or historic period.

Precontact archaeological resources include lithic scatters, groundstone artifacts, camps, villages, house pits, trails, cairns, rock alignments, talus pits, petroglyphs, pictographs, shell middens, fishing stations, fish weirs, and burials, as described below:

- *Lithics* are chipped-stone artifacts manufactured with percussion and pressure techniques. Projectile points (or fragments), bifaces, flake tools, cores, and debitage are all common lithic artifacts found in archaeological sites throughout the study area.
- *Groundstone artifacts* are stone artifacts produced by grinding and include mortars, pestles, and adze blades, among other types within the study area and often within lithic scatters.
- *Camps* are short-term occupation sites that contain cultural materials such as lithics and groundstone that were typically used in the processing of foodstuffs.
- *Villages* are larger house sites or clusters of dwelling and house pits, which are often found along major rivers and their tributaries.
- *House pits* are dwellings that are partially dug into the ground and contain a roof, which are used as shelter, storage, and gathering places.
- *Trails* are routes or pathways that are sometimes associated with TCPs and/or significant destinations.
- *Cairns* are rock piles that may be marking caches or burials.
- *Rock alignments* are walls, circles, figures, and other features constructed out of rock and may be related to hunting, hold geographic significance, or be ceremonial in nature.
- *Talus pits* are depressions in talus slopes that were used as hunting blinds, or as storage or caches.
- *Petroglyphs* are a form of rock art where the surface of the rock has been carved, etched, incised, rubbed, and/or pounded to create images.
- *Pictographs* are another form of rock art where the rock surface has been painted.

- *Shell middens* contain a matrix of shell, faunal bone, fire-modified rock, lithics, groundstone, botanical species, and other materials, and are almost always located along marine or riverine settings. They can also contain human and animal burials. Shell middens can occur within villages next to or below longhouses, as well as at more temporary camps used for hunting and gathering resources.
- *Fishing stations* are locations where fishing and subsequent processing occurred. They often contain standing platforms, lithic tools, and fish weirs.
- *Fish weirs* are structures typically built of stone, wooden posts, or reeds and placed nearshore to catch fish as they swim along with the current.
- *Burials* contain human remains, funerary objects, and items of cultural patrimony.

Historic archaeological resources may include cairns, petroglyphs, maritime properties, homesteads, debris scatters, townsites, residential structures, agriculture, railroad properties, mining properties, logging properties, roads, cemeteries, religious properties, commercial properties, military properties, and water structures, as described below:

- *Maritime properties* can include schooners, tugboats, and light stations in ruin and/or submerged.
- *Homesteads* contain houses or house foundations, associated structures, and often orchards and debris scatters.
- *Debris scatters* are concentrations of refuse including cans, glass, ceramic, pottery, nails, and other domestic and/or industrial items.
- *Townsites* are locations of former towns with no extant buildings, often evidenced by historic records and foundations and/or depressions.
- *Residential structures* include homes, cellars, garages, sheds, and privies in ruin.
- *Agriculture*-related resources include designed landscapes, stock pens, corrals, fences, and canal or irrigation features.
- *Railroad properties* include intact segments or those missing one or more components, campsites, berms, trestles, tunnels, material dumps, and associated structural ruins.
- *Mining properties* include collapsed mine portals, campsites, and tailings.
- *Logging properties* include segmented and/or structural ruins such as mills, flumes, chutes, and railroads, and logging camps.
- *Roads* include segments and abandoned roadbeds.
- *Cemeteries* include marked burials, which are often associated with religious properties.
- *Religious properties* include churches, parsonages, and rectories.
- *Commercial properties* include stores in the study area.
- *Military properties* include forts and pump stations.
- *Water structures* include piers, pilings, and docks in ruin and/or submerged.

Reserved Treaty Rights

Indian trust resources include the collective right and access to hunt, fish, gather, and collect traditional materials and native resources for use by Indian tribal members. These resources may be used for commercial, subsistence, and ceremonial purposes. The Columbia River, its tributaries, uplands, and mountains provide a variety of plants, animals, and materials traditionally and currently used in or as medicines, foods, tools, textiles, building materials, carvings, and sacred objects.

Tribal resources within the Columbia River include six species of salmon and Pacific lamprey, which have been a reliable and important source of food and trade items to tribes of the Columbia River Treaty, including the Yakama, Warm Springs, Umatilla, and Nez Perce (Harrison 2008, Grabowski 2015). The Confederated Tribes of the Grand Ronde also hold treaty rights to the Lower Columbia and Cowlitz rivers (Thorsgard et al. 2013). Additional types of subsistence resources located along the Columbia River and its shorelines in a variety of habitats include sucker, trout, pikeminnow, eulachon, flatfish, green sturgeon, oysters, clams, mussels, crabs, sea lion, otter, waterfowl, deer, and elk. Vegetation resources in these areas include lupine, horsetail, camas, sweetgrass, cattail, willow, wapato, cow parsnip, wild celery, and berry varietals, among others. The geographic reaches of these resources are discussed in Sections 3.4, 3.5, and 3.6.

U&A areas include villages and temporary or permanent fishing or hunting camps, often used by generations of tribal members. U&A areas are sometimes also recorded as archaeological sites or TCPs; however, such recordation has not always been completed. Precise locations of U&A areas are listed where known; however, often this information is not available to the general public (Bureau of Indian Affairs [BIA] 1975). Often information on specific U&A areas important to a tribe is gained through consultation.

3.13.1 Methods of Analysis

The study areas for assessing potential impacts to cultural resources include:

- **The proposed Facility study area.** Areas at the Port potentially disturbed by construction and operation of the proposed Facility in the northwestern corner of Terminal 5, Parcel 1A, Berths 13 and 14 in Terminal 4, and pipeline areas that connect these three areas.
- **The rail corridor study area.** From the Washington-Idaho border to the Port, including a 0.5-mile corridor along each side of the rail line within Washington and portions of Oregon; and the rail corridor outside of Washington from the Washington-Idaho border to Williston, North Dakota (qualitative analysis only).
- **The vessel corridor study area.** Includes 106 river miles along the Columbia River between the site of the proposed Facility and the Pacific Ocean, including a 0.25-mile area landward from the high water mark along both the Washington and Oregon Columbia River shorelines; and the vessel transit areas within the Pacific Ocean beyond the 3-nmi boundary past the Columbia River mouth (qualitative analysis only).

Impacts from the proposed Facility were evaluated based on the presence and types of cultural resources found on, and adjacent to, the proposed Facility site. The Applicant submitted a cultural resources report documenting all known previously conducted cultural resources studies and surveys in areas potentially affected by the proposed Facility (AINW 2015). The Applicant also conducted a total of 39 geotechnical borings at the proposed Facility site, which were reviewed for data pertaining to cultural resources and lithostratigraphic units.

Impacts to cultural resources from rail and vessel operations associated with the proposed Facility were evaluated based on cultural resource types within the rail and vessel study areas. A literature review of the types of cultural resources commonly found in these study areas was completed using information from repositories including University of Washington and Seattle Public Library. Evidence of previously recorded cultural resources within all study areas was obtained from the Washington Information System for Architectural and Archaeological Records Data (WISAARD), Oregon Archaeological Records Remote Access (OARRA), websites, books, and cultural resource reports, historical and aerial photographs, archival sources, and historical maps (e.g., topographic quadrangles, General Land Office [GLO] maps, and Sanborn Fire Insurance maps). In addition, U&A resource locations and information was also identified by conducting a desktop study of tribal websites, the Columbia River Inter-Tribal Fish Commission, and the BIA.

Site records and inventory forms for cultural resources within these study areas were reviewed including those listed or eligible for the Washington Heritage Register (WHR) and National Register of Historic Place (NRHP). Information concerning site type, location, and age of archaeological resources, historical resources, and properties of religious and cultural significance, including TCPs, were gathered from these records and forms.

The rail corridor study area and vessel corridor study area were divided into consecutive 5-mile sections. The total counts of archaeological and historic resources identified in the literature review for each 5-mile section were documented in a database. Resource counts included any portion of a site within a section. Due to the high number of cultural resources and extent of the study areas, two density gradients were developed to present concentrations of resources visually. The density gradients are based on an ordinal scale of 0 to 76 for archaeological resources and from 0 to 526 for historic resources within a given section. A series of maps were created displaying the site density-based gradient for the study areas for rail and vessel operations (Appendix P.7).

3.13.2 Affected Environment

The proposed Facility study area and parts of the rail and vessel corridor study areas for cultural resources are located within the Port, the Columbia River, and the Columbia Basin. In historical times, the Port consisted of many scrub forests and wetlands and a few small lakes. However, due to recent mechanical modifications such as levee construction, dredge spoil deposition, and other industrial developments, the landscape has been significantly modified (Fuld et al. 2013). The Port has been an industrial site since 1912 where much of the native soils have been modified and covered with artificial fill, gravel, asphalt, and sand. Sediments that were previously dredged from the Columbia River have been deposited along the shoreline (Fuld et al. 2013). The Columbia River has thick basalt flows and consists of marshes, wildlife areas, agricultural fields, and industrial operations along its shorelines (Fuld et al. 2013). The Columbia Basin is characterized by incised rivers, extensive plateaus, and ridges of basalt covered by lacustrine sediments and loess, which make for fertile agricultural fields and diverse wildlife areas (WDNR 2015).

Precontact Background

The proposed Facility study area and parts of the rail and vessel corridor study areas lie in two regions that are culturally diverse: the Plateau culture area and the Northwest Coast culture area. **The Plateau culture area** extends from the Cascades to the Rockies and from the Columbia River into southern Canada (Ames et al. 1998). **The Northwest Coast culture area** extends from the northern Canadian coast to Oregon and is bounded on the east by the Cascade Mountains (Suttles 1990). The site of the proposed Facility is within the Portland Basin, which is considered the bottomlands of the Columbia River, within the Northwest Coast culture area. The following section discusses the broad cultural history in the southern Plateau and the southcentral Northwest Coast.

Plateau Culture Area History

The antiquity of human occupation in the Plateau extends to at least 11,500 years before present (BP). The early inhabitants of the region were called Paleo-Indians, who were highly mobile large-game hunters.

The Early Archaic period (11,000-7,000 BP) is characterized by small groups of mobile hunter-gatherers (Aikens 1993, Ames et al. 1998). Artifacts from this period include stone and bone projectile points, cobble tools, bifacial knives, hammerstones, needles, awls, antler wedges, beads, and ochre, among others. People kept a diverse diet that included elk, bison, deer, pronghorn, a variety of lagomorphs, seals, birds, and fish (Ames et al. 1998).

During the Middle Archaic period (7,000-5,000 BP), the region became warmer and drier and hunter-gatherers lived in small, mobile groups and hunted game and collected some plants and roots. Artifacts from this time period include stone projectile points, bifacial knives, milling stones and pestles, and bone and antler tools (Ames et al. 1998). People lived in semisubterranean pit houses (Ames et al. 1998).

During the Late Archaic period (5,000-150 BP), people began to settle in pit houses, tule mat-covered long houses, and lodges, and they relied on fishing, the storage of salmon, and the harvesting of camas (Ames et al. 1998). People spent winters in villages and summers in temporary camps. Artifacts typically include stone projectile points, milling stones, decorated pestles, net weights, bone and antler tools, cordage and matting, basketry, bows and arrows, and composite harpoons, among other fishing implements (Ames et al. 1998). Sculpted stone pieces appear circa 3,000 BP, as do large cemeteries. Euro-American trade goods began appearing during the protohistoric end of the Late Archaic period. The horse was introduced around 1730 AD, which increased mobility and transport capabilities and, subsequently, strengthened existing trade networks and broadened the range of trade throughout the Plateau (Haines 1938, Schalk 1980).

The Late Archaic period experienced cooler conditions similar to today’s environment. The ethnographic record is likely a continuation of the lifeways and subsistence strategies that were in place by at least 3,000 BP (Fagan 1974). These strategies began as a response to climatic change and included an economic diversification and increase in root and seed processing (Fagan 1974).

Northwest Coast Culture Area History

The earliest known occupations in the Northwest Coast were Paleo-Indian between 13,000 and 12,500 BP (Carlson 1990, Ames and Maschner 1999). Paleo-Indians were hunter-gatherers with small populations and high levels of mobility. Much of the late Pleistocene terrain was uninhabitable due to glaciers, and the lands that were occupied by Paleo-Indians were predominately coastal reaches. Some researchers have presented the case that these early people were maritime oriented (Dixon 1993, Fedje and Christensen 1999, Carlson 2003). During the glaciation period, ocean levels fell almost 400 feet globally (Kirk and Daugherty 2007). Approximately 12,000 BP, the climate began to warm, which caused ocean levels to rise and resulted in the submersion of many of these coastal sites. However, some landforms rebounded after the glaciers retreated and are located above the present shoreline (Fedje and Christensen 1999).

The Archaic period dates from approximately 12,500 to 6,400 BP (Carlson 1990, Ames and Maschner 1999). Changes in sea level and vegetation have obscured many Archaic period sites along the coast (Ames and Maschner 1999). However, as the glaciers receded, people were able to occupy larger expanses inland. Archaic period people lived in highly mobile small groups and focused on a combination of maritime, littoral, and terrestrial economies (Ames and Maschner 1999). Artifacts are similar to those in the Plateau region, but also include microblades[1] (Ames and Maschner 1999).

The Pacific period dates from approximately 6,400 to 250 BP and ends at the introduction of smallpox to the region (Ames and Maschner 1999).

1 Very small blade tools.

The Early Pacific period (6,400 to 3,800 BP) was marked by the increased use of marine resources, the appearance of human burials in middens and cemeteries, a diversification in subsistence activities, the disappearance of microblade technology, and the increased use of bone, antler, and groundstone tools. Major developments also include the appearance of groundstone celts (adze blades), a proliferation in chipped-stone tool forms and styles, and decorative/ornamental pieces that likely represent contact and trade with groups in neighboring cultural areas (Kirk and Daugherty 2007).

The Middle Pacific period (3,800 to 1,800/1500 BP) displays major developments including the appearance of long-term settlements (plank houses), intensification of salmon capture (appearance of wooden fish weirs and girdled/drilled net sinkers), and diversification in tool form and style.

Late Pacific period (1800/1500 to 250 BP) developments are represented by the appearance of heavy-duty woodworking tools, an overall decline in the use of chipped-stone tools, and an increase in funerary ritual/burial activities. Sea levels became stable by the start of the Middle Pacific period, and sites representing the Middle and Late periods are located across the Northwest Coast region (Ames and Maschner 1999).

Ethnographic Background

The proposed Facility study area and parts of the rail and vessel corridor study areas lie within areas historically used by multiple Coast Salish-, Chinook-, and Sahaptin-speaking people.

Plateau

Significant variability exists in the Plateau cultural area due to the mountainous terrain and various climatic zones. Plateau peoples adapted to these differing ecoregions largely by practicing transhumance, whereby groups followed resource seasonal availability. Walker (1998a) defines eight key features of the Plateau: riverine settlement patterns; reliance on diverse subsistence (anadromous fish, game, and roots); a complex fishing technology; mutual cross-utilization of subsistence resources across groups; extension of kinship ties through intergroup marriage; extension of trade links through partnerships and regional gatherings; limited political integration at the village and band levels; and relatively uniform mythology, art styles, and religious beliefs.

Indigenous people who spoke Chinookan and Sahaptin lived in the Columbia Plateau. The Cascades, Wasco, and Wishram peoples spoke Upper Chinook dialects and lived just east of the Cascade Mountains in both Oregon and Washington (French and French 1998). A boundary lay between the Chinookan- and Sahaptin-speaking people at Fivemile and Tenmile Rapids (French and French 1998). The groups who spoke Sahaptin that lived within the parts of the rail and vessel corridor study areas included the Yakama, Kittitas, Klikitat, Taitnapam, Wanapam, Tenino, Warm Springs, Umatilla, Walla Walla, Cayuse, Sinkayuse, Palouse, and Spokane (Hunn and French 1998, Miller 1998, Ross 1998, Schuster 1998, Sprague 1998, Stern 1998). Additional neighboring groups also visited parts of the rail and vessel corridor study areas, including the Nez Perce and the Coeur d’Alene tribes (Palmer 1998, Walker 1998b).

Information from the contact period suggests that at the time of contact with Euro-Americans, the winter village pattern was still in practice from the pre-ethnographic period. Traditional lifeways focused on the riverine and upland lifestyles and diverse subsistence base of fish and shellfish, game, berries, and root resources (Walker 1998a). The tribes in the area would spend the winter along the Columbia River shoreline in winter villages (Walker 1998a). Columbia Plateau tribes lived in bands and would spend their winters along the major rivers and tributaries. Winter villages were permanent and were the center of social, economic, and political activities (Walker 1998a). The tribes would move up into the mountains during summer and fall as foods became seasonally available. Spring, summer, and fall camps were temporary and used while engaged in resource procurement activities.

Division of labor was based on gender, where women would typically dig roots (e.g., camas and bitterroot) and pick berries (e.g., serviceberry and huckleberry). Men would typically hunt game and fish through set gillnets, drifting gillnets, dip nets, fish weirs, and fish traps. Surpluses of food were dried and stored in the winter villages for consumption during winter months, though some fresh game and fish were also taken during winter (Walker 1998a). Stored foods, including salmon, berries, and roots, provided the bulk of sustenance through the winter. Root-harvesting grounds, which were shared by several groups of people for socialization, ceremony, and trade, included various resources such as camas (*quamash*), bitterroot (*piahe*), and *skolkul* (Ray 1936, Anastasio 1972). Intermarriage between groups served to strengthen trade networks and intergroup resource sharing. People also shared mythologies and religious beliefs and practices, which consisted of vision quests, shamanism, life-cycle observances, and seasonal celebrations of the annual subsistence cycle (Walker 1998a:3).

Indian fishers today implement similar fishing techniques as those reported in ethnographic times, the most common of which are gillnets that are set via shore access or by boat.

Northwest Coast

Similar to the Plateau, variations in the Northwest Coast cultural area exist due to environmental differences. However, several commonalities exist among all Northwest Coast groups (defined in Suttles 1990): diverse subsistence based on fish, shellfish, roots, and game; highly developed woodworking technology (for fishing, plank houses, and dugout canoes); permanent winter villages; social stratification with hereditary slavery; regional social system and intermarriage; and artistic abilities with carving, painting, and textiles.

Indigenous people who spoke Chinookan and Salish lived within the Lower Columbia River. The Chinookan-speaking people consisted of multiple groups who spoke different dialects including the Lower Chinook, Cathlamet, Multnomah, and Clackamas (Silverstein 1990). The Cowlitz lived farther upriver from the Chinook peoples around the Cowlitz River and spoke a Coast Salish dialect. The Cowlitz traveled regularly to the Chinook territory for gatherings and to trade (Hajda 1990).

The Lower Columbia peoples lived in large villages that contained one or more plankhouses along major waterways (Fuld et al. 2013, Sobel et al. 2013). Temporary housing was used during hunting and foraging trips. The subsistence economy focused on seasonally available foods including salmon, sturgeon, eulachon, and freshwater fishes; birds; aquatic mammals; land mammals (e.g., deer and elk); and plant foods (e.g., berries, nuts, roots, bulbs, and tubers) (Fuld et al. 2013:5). The household operated as the basic social, political, economic, and demographic unit (Sobel et al. 2013).

These groups developed a complex social and religious system primarily due to the abundance of resources (Silverstein 1990). Potlatches and spirit quests were important activities in the pursuit of spiritual power in addition to asserting control over resources and neighboring groups (Suttles 1990). Chipped-stone, groundstone, bone, and antler tools made up most of the toolkit. A variety of source material was used to make stone tools and the importation of exotic toolstone indicates widespread regional interaction (Grier 2007). Other trade items, such as dentalium,[2] were often used as currency (Silverstein 1990). A wide range of vegetative species was used to make baskets, decorative items, and other daily objects. Labor specialization in hunting, harpooning, basketry, and wood working also occurred.

Fishing techniques today are similar to those of the Plateau. Lower Columbia peoples began commercial fishing in the 1800s when they sold fish to the Hudson's Bay Company (HBC).

2 Tooth shells or tusk shells.

History

Indian tribes encountered trade items and diseases before meeting the first Euro-Americans, which occurred circa 1790 when a merchant ship captained by Robert Gray entered the Columbia River mouth and met the Chinooks (Lang 2013). Additional ships soon entered the Columbia estuary including the *Discovery* captained by George Vancouver and the *Jenny* captained by James Baker (Lang 2013). As the sailors began mapping the Lower Columbia River, marine trade between Euro-Americans and indigenous populations flourished. Furs were traded for Euro-American goods such as iron, copper, firearms, cloth, blankets, ornaments, clothing, beads, food, and liquor (Cole and Darling 1990).

Lewis and Clark traveled through the Columbia Plateau on the Snake and Columbia rivers in October 1805, reaching the Columbia River estuary in November of the same year (Walker and Sprague 1998, Lang 2013). The Corps of Discovery built Fort Clatsop near present day Astoria by the end of 1805 (Lang 2013). They were soon followed by other explorers including the Canadian North West Company's David Thompson (Walker and Sprague 1998). Thompson was the first Euro-American to traverse the entire length of the Columbia River and passed through the proposed Facility study area in 1811. Fur companies followed shortly thereafter and established trading posts across the interior, which attracted trappers, military units, and miners to the region (Meinig 1968). Other fur companies entered the region including John Jacob Astor's Pacific Fur Company and the British HBC. The North West Company established Fort Nez Perces (known later as Fort Walla Walla) in 1818 near the Walla Walla River mouth. The HBC bought out the North West Company in 1821, and in 1824, they established Fort Vancouver (Hunn 1990). The HBC used the northern shore of the Columbia River within the proposed Facility study area and parts of the rail and vessel corridor study areas for farming, pastures, and dairying (Fuld et al. 2013:5). The establishment of forts and posts promoted land-based trade between the Indian groups and Euro-Americans. In addition, some tribes, such as the Chinookans, also traded direct labor for transportation, repair and maintenance of canoes, excavation and construction work, and garden cultivation and tending (Lang 2013).

Mass migration of settlers began around 1843, which marked the advent of the Oregon Trail. Prior to that time, the Oregon Trail had been a network of Indian trails that were also used by fur traders and other emigrants (National Historic Oregon Trail Interpretive Center nd). Missionaries also entered the region in the early 1800s. The Whitman Mission near Waiilatpu on the Walla Walla River was established between 1835 and 1836 (Hunn 1990). Methodist stations were established: one at The Dalles called Wascopam in 1838 (Hunn 1990) and one at Clatsop Plains on the Lower Columbia River. Roman Catholic priests often preached at Fort Vancouver in the language of the Chinookans (Cole and Darling 1990). Early settlers traveled through the Blue Mountains on their way to western Oregon and Washington, often stopping at the Whitman mission for supplies. The Whitman mission, however, was not successful in converting the Cayuse to Christianity, and after bouts of scarlet fever and measles that emigrants introduced, some Cayuse members killed the Whitmans and 11 others at the mission beginning on November 29, 1847 (Meinig 1968).

The proposed Facility study area and parts of the rail and vessel corridor study areas are within the area known as the Oregon Country, which was a region that was subject to the joint occupation of the United States and Great Britain (Marino 1990). The Oregon Country agreement was reached in 1818 and renewed in 1827. The Oregon Territory was created in 1848 under the Organic Act, which gave all tribes south of the 49th parallel legal assurance that their lands would not be taken without their consent (Marino 1990). The US Congress ended slavery in the Oregon Territory and passed a bill on August 13, 1848, that established a territorial government in Oregon. Anson Dart, Superintendent for Indian Affairs, negotiated 19 treaties at Tansy Point on the southern shore of the Columbia River mouth in 1851; however, none of the treaties were ratified (Beckham 1990).

The Washington Territory was organized in 1853. In 1853, Joel Palmer and Isaac Stevens were selected to represent Indian Policies for the Northwest. They met with representatives of a majority of the tribes and signed treaties during numerous councils. Stevens met with the Chinook and other southwestern Washington tribes in 1855; however, no treaty was signed. The following tribes signed treaties in 1855 that were ratified in 1859: Walla Walla, Cayuse, and Umatilla; Yakama; and Warm Springs (Beckham 1990). Reservations were created for those tribes that signed. The Spokane Reservation was created by Executive Order in 1881.

Miners entered the region in the mid-1800s once gold was discovered, which spurred the development of little towns and thousands of mining claims. Homesteaders and loggers also came to the region, which increased hostilities with the Indian tribes. Open conflict between the tribes and the homesteaders intensified in the mid-1850s after the Donation Land Act of 1850.

In 1858, tensions between Euro-American settlers and Indian tribes increased in the region due to many factors, but particularly from smallpox outbreaks and the presence of miners on reservation lands. The US Army clashed with an allied contingent of Spokane, Coeur d'Alene, Palouse, Kalispel, Colville, Okanogan, Yakima, Cayuse, Walla Walla, and Nez Perce warriors near present-day Rosalia in 1858. The US troops suffered a devastating defeat, thwarting military efforts to assert authority in Colville Country. Additional skirmishes occurred between the US Army and Plateau tribes near Spokane throughout September 1858.

Many settlers traveled south for the Gold Rush in California, which created a lucrative market for wheat, apples, vegetables, oysters, shingles, piling, and lumber, effectively stimulating the Oregon economy (Oregon Blue Book 2013). By the 1860s, some settlers near the Oregon coast began to move east of the Cascades with surplus livestock due to high land prices in the west (Oregon Blue Book 2013). Oregon became a state in 1859 and shortly thereafter entered the Civil War. The USGS began working in Oregon in the 1870s, resulting in the production of maps for the entire state that covered roads, settlements, terrain, and forests.

Oregon Steam Navigation Company built the first railroad in Oregon in the early 1860s for use in mining east of the Cascades. The Oregon & California Railroad, which ran from Portland to the Sacramento Valley, was constructed between the 1870s and the 1880s. The railroad opened western Oregon valleys to exporting lumber, wool, and livestock, and the sale of fruit and other agricultural commodities (Oregon Blue Book 2013). Oregon forest reserves were established in the late 1800s.

Agriculture was the main industry in the Columbia Plateau in the mid-1800s, which helped to develop Spokane and its surrounding areas. Steamships began running on the Columbia River in 1853 and were followed by the first railroads in 1881 and 1883. The arrival of the Northern Pacific Railroad in 1881 caused rapid economic expansion in the region, and three additional transcontinental railroads were added by the early 20th century. In 1889, Washington Water Power Company began to construct hydroelectric developments in Spokane, which contributed to rural electrification, railroad expansion, and agricultural growth. The expanding railroads enticed Euro-Americans to settle in the Columbia Plateau, which provided rich soils and suitable climate for agrarian pursuits. The region soon contained orchards, vegetable gardens, greenhouses, and fields of wheat, barley, and oats. The industry in the Lower Columbia River turned to timber, wheat ranching, and salmon fishing in the late 1800s and early 1900s.

By the first decades of the 1900s, irrigation systems and canals in the Spokane River Valley channeled water from surrounding lakes and other sources of water into large fields and orchards; however, dry farming also continued in some areas. The first highways were built in the early 1900s, including the Columbia River Highway in the 1920s. Communities developed alongside the new roads such as Bingen, Lyle, Hood River, Stevenson, and Cascade Locks.

Changes to the Columbia River also occurred through the construction of locks and hydroelectric dams (Columbia River Gorge nd). Cascade Locks were completed in 1896 and Bonneville Dam was completed in 1938. Celilo Lock and Canal opened in 1915, Dalles Dam was built in 1957, and John Day Dam was built in 1971. These changes aided river navigation and provided flood control and electricity.

The Port's Parcel 1A land (storage area [Area 300]) is shown on the 1863 BLM GLO map as within the former Donation Land Claim (DLC) of Henry Van Allman (DLC No. 57). Van Allman was born in Switzerland, immigrated to the Oregon Territory in 1847, and settled on a 311.37-acre DLC (BergerABAM 2014). Joseph Petrain purchased Van Allman's DLC in 1859 and used the land for livestock grazing and agriculture (BergerABAM 2014). Petrain worked for the HBC and arrived in Clarke County from Canada in 1836 (BergerABAM 2014). The Port's Terminal 5 land is within the former DLC claim of Indiana-born John Henry Matthews (DLC No. 44), which was settled in 1852 (BergerABAM 2014). Matthews' DLC was 289.06 acres. The 1929 Metsker Map for Township 2 North, Range 1 East, Willamette Meridian depicts Parcel 1A (storage area [Area 300]) as part of a larger property owned by the Grays Harbor Lumber Company, which was acquired for a sawmill site, and Terminal 5 as owned by the Spokane, Portland, and Seattle Railway (BergerABAM 2014:4-227).

The early GLO maps and the 1897 USGS 15-minute Portland, Oregon, quadrangle map depict the original alignment of the Lower River Road, which is now the NW Old Lower River Road (BergerABAM 2014). In its original alignment, the road paralleled the Columbia River on the terrace above the shoreline and passed through the proposed Facility site (BergerABAM 2014). The road was shifted north in 1905 to its current alignment (BergerABAM 2014).

The Port of Vancouver was established in 1912. It entered into a contract with G.M. Standifer Construction Corporation to build a shipyard to assist the World War I effort (BergerABAM 2014). This shipyard was east of the Project area. Terminal 1 was acquired in 1925. A grain export facility was constructed in 1934 at Terminal 2, where harbor cranes were acquired for unloading large shipments in 1959 (BergerABAM 2014). Terminals 3 and 4 were developed by 1963 and Berths 13 and 14 were constructed in 1993 (BergerABAM 2014). The Port acquired land that was formerly owned by the Evergreen and Alcoa aluminum industries to develop Terminal 5 in 2009 (BergerABAM 2014). Terminal 5's rail loop was completed in 2010 (BergerABAM 2014).

3.13.2.1 Proposed Facility

Archaeological Resources

The proposed Facility study area is located within Level A or high (80 to 100 percent) probability on the Clark County archaeological predictive model and is a "Survey Highly Advised: Very High Risk" area in Washington State Department of Archaeology and Historic Preservation's Washington Statewide Predictive Model (BergerABAM 2014).

Sixteen surveys have been conducted within the proposed Facility study area (Table 3.13-1). Figure 3.13-1 depicts the cultural resource surveys previously conducted at the proposed Facility site and immediately surrounding areas.

No archaeological resources or TCPs have been identified within the proposed Facility study area (BergerABAM 2014). The historic NW Old Lower River Road extends through part of Parcel 2 outside of the study area but no archaeological sites have been observed in its vicinity (BergerABAM 2014).

No cultural resources were encountered during the 39 geotechnical borings at the proposed Facility site (AINW 2015).

Table 3.13-1. Previously Recorded Surveys within the Proposed Facility Study Area

Author	Date	Area Investigated	Findings
Thomas and Welch	1982	Parcel 1A (Area 300 Storage)	20th century dairy farm (outside study area); section of original Lower River Road (outside study area)
Forgeng and Reese	1993	Parcel 1A (Area 300 Storage)	No cultural resources
King	1995	Parcel 1 (north of study area)	45CL408 (outside study area)
Thomas	1995	Cogentrix Power Plant (north of study area)	No cultural resources
Moore et al.	1997	Clark County Jail Work Center	No cultural resources
Ellis and Mills	1998	Clark County Jail Work Center	No cultural resources
Becker and Roulette	2003	Terminal 5	No cultural resources
Zehendner and Fagan	2008	Columbia River shoreline	No cultural resources
Reese	2009a	Terminal 4 Parcel 1A (Area 300 Storage)	No cultural resources
Reese	2009b	Terminal 4 Pond Reconstruction	No cultural resources
Fagan and Zehendner	2009	Terminal 5	No cultural resources
Hetzel et al.	2009	West Vancouver Freight Access Terminal 5 Clark County Jail Work Center	No cultural resources
Chapman and Blaser	2010	Terminal 5	No cultural resources
Davis and Ozbun	2011	Parcel 2 (north of study area)	No cultural resources
Jenkins and Davis	2012	Parcel 2 (north of study area)	No cultural resources
Fuld and Reese	2012	Clark County Jail Work Center	No cultural resources

Source: BergerABAM 2014, Table 4.14-1

The proposed Facility study area lies within the boundary of Vancouver Lakes Archaeological District (45DT101). The district consists of seasonally wet prairies, marshes, tidal beaches, and wooded areas within 3,706 acres of alluvial floodplain from the Columbia River, Vancouver Lake, Lake River, Lewis River, and other associated waterbodies (BergerABAM 2014:4-229), none of which are located within the Facility study area (BergerABAM 2014).

Historic Resources

No historic resources have been identified within the proposed Facility study area from information provided by the Applicant (BergerABAM 2014) or from independent reviews by EFSEC.

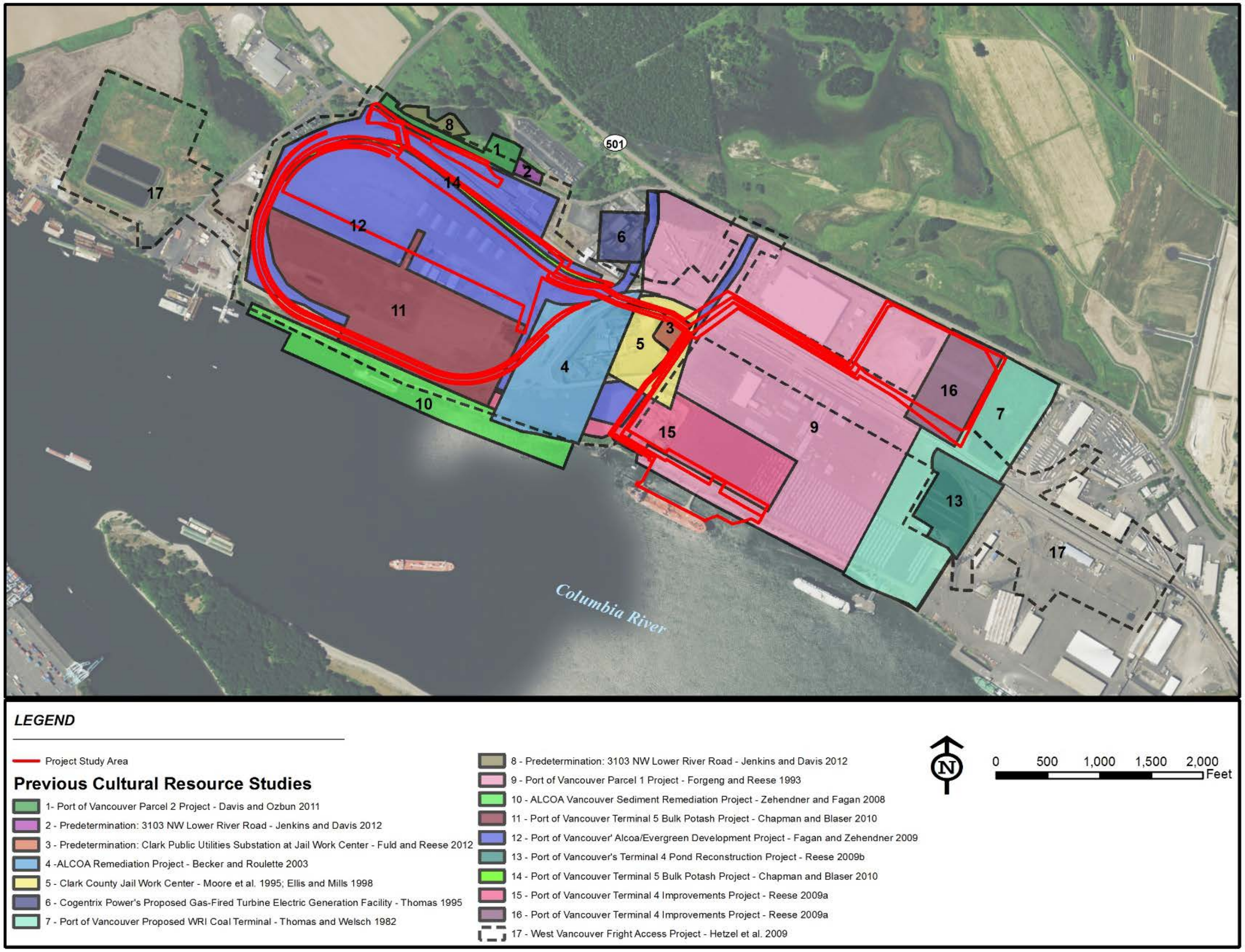

Figure 3.13-1. Cultural Resources Survey Area

Note: An enlarged version of this figure is available in Appendix P.11.

Reserved Treaty Rights

Currently, no known U&A lands lie within the proposed Facility study area.

3.13.2.2 Rail Corridor

Archaeological Resources

Previously recorded archaeological sites and isolated finds occur within the rail corridor study area; however, some archaeological resources that have not been recorded likely exist. Figures in Appendix P.7 display the density of archaeological resources. Many previously recorded resources contain both precontact and historic archaeological materials. Lithic scatters are the most common precontact archaeological site type in the rail corridor, followed by camps, cairns, rock alignments, villages, house pits, petroglyphs, pictographs, shell middens, talus pits, burials, fishing stations, and trails. Historic period archaeological sites number fewer than precontact resources in the rail corridor, the most common of which include debris scatters, structures, agriculture, and railroad properties. Less common historic period archeological sites in the rail corridor include homesteads, commercial properties, water structures, roads, cairns, petroglyphs, maritime properties, townsites, mining properties, cemeteries, religious properties, and military properties.

The rail corridor passes through seven archaeological districts. The Plymouth District, Sk'in Village Cultural District, and Vancouver Lakes Archaeological District contain precontact and historic components. The Crow Butte Island District, Columbia Hills Archaeological District, Miller Island District, and Wishram Indian Village Site all contain precontact features and sites.

The highest concentration of archaeological resources is found along the Columbia River near Celilo Falls at the confluence with the Deschutes River, The Dalles, and Portland Basin. The upland areas immediately adjacent to Spokane contain the most resources, while the remaining uplands contain very few archaeological resources. In part, this density is due to the precontact and protohistoric Plateau and Northwest Coast lifestyle pattern of spending winters along major rivers and dispersing into smaller groups in spring and summer. Additionally, the types of activities that occurred in these different geographic regions can have a profound effect on the types of cultural materials that are left behind. For example, generational villages are easier to identify than a short-term hunting camp used once. These areas also have experienced different degrees of archaeological inquiry. More archaeological research has occurred in developed areas, such as Spokane, Portland, and Vancouver, and along the Columbia River than in the uplands.

Five TCPs were identified within the rail corridor study area during the literature review, three of which are associated with oral traditions, one with ethnographic land use, and one with an ethnographic village. Four of the TCPs are recorded as archaeological sites. The literature review indicates another ethnographic village present within the rail corridor study area but its presence could not be confirmed.

Outside of Washington, archaeological resources occur in close proximity to the rail lines. Types of archaeological resources outside the state are similar to those found within the state including, but not limited to, lithic scatters, groundstone and ceramic artifacts, middens, burials, rock cairns and other rock features, village sites, camp sites, can scatters, and trails.

Historic Resources

Previously recorded NRHP- and WHR-eligible historic resources occur within the rail corridor study area (Figures in Appendix P.8 display the densities). Some of these resources may no longer exist and other resources that have not been recorded likely exist within the rail corridor study area. Historic resources are scattered throughout the study area with the highest concentration occurring in urbanized areas near Spokane and Vancouver.

Residential areas are located throughout the rail corridor study area dating from the late 19th through the mid-20th century, exhibiting a variety of architectural styles and building types.

Portions of the BNSF railroad corridor have been determined eligible for the NRHP. Historic resources associated with the railroad include depots, railway bridges, and loading ramps. The city of Spokane and surrounding areas contain a high concentration of historic rail resources. Other NRHP/WHR-eligible transportation resources in the rail corridor study area include bridges, roads, and airports.

Commercial buildings are clustered near the railroads that historically supported workers and travelers using the railroad (e.g., hotels, apartment complexes, and restaurants), and the warehouses and production facilities of the Inland Brewing and Malting Company in Spokane facilitated the movement of goods.

Historic districts contain high concentrations of resources that are linked by their period of development and significance in American history. Historic Districts in Spokane include Millwood Historic District, West Downtown Historic District, and Riverside Avenue. Other historic districts in the rail corridor study area include Ritzville Historic District and Cheney Historic District. Some historic districts, such as Fort Vancouver National Historic District, are also designated National Historic Landmarks.

Educational facilities located in the rail corridor study area include Libby Junior High School and Lincoln School in Spokane and Cheney High School. Government facilities include Cheney Post Office, Adams County Courthouse, and Okanogan Armory Flammable Storehouse.

Religious and cultural facilities are found through the rail corridor study area including churches in. Spokane and Cheney listed on the NRHP. Recorded theaters include Ritzville Theater, Kiggins Theater in Vancouver, and Aubert Theater in Connell. Facilities developed for fraternal organizations including the Oddfellows, Fraternal Order of the Eagles, and the Masons are eligible for the NRHP and WHR.

Power generation and distribution systems in the area include Bonneville Power Authority facilities in Bonneville, Cheney, and Celio, which have been determined eligible for the NRHP.

Outside of Washington, historic resources of similar types as those within the state such as residences, religious and cultural institutions, and school and government buildings occur in close proximity to the rail lines. For example, the Great Northern Railway Depot and other resources associated with the railroad in Kalispell and Whitefish are located adjacent to the rail corridor, and the old US Post Office is located approximately 0.33 mile from the rail corridor in Williston, North Dakota.

Reserved Treaty Rights

U&A fishing and hunting areas for several treaty tribes lie within the rail corridor (BIA 1975, Columbia River Inter-Tribal Fish Commission nd). U&A areas within the rail corridor study area are primarily located in or near the Columbia River, including locations near Celilo Falls, Skein, the mouth of Rock Creek, White Salmon River, Little Ah-teem, Spearfish (Wishram), Crow Butte, Sun Dale, John Day North Shore, and Avery near The Dalles (BIA 1975, Martin 2002, Columbia River Inter-Tribal Fish Commission nd). In addition, Niŝxt, located near Coyote Island is a recorded location of traditional fishing (USACE 2014). Some of these areas are inundated by the river. The Columbia River Inter-Tribal Fish Commission maintains 31 fishing sites along the Columbia River between McNary and Bonneville dams for the exclusive use of Indian commercial fishers (Columbia River Inter-Tribal Fish Commission nd). These areas are used to fish, hunt, and collect treaty resources.

3.13.2.3 Vessel Corridor

Archaeological Resources

Previously recorded archaeological sites and isolated finds occur within the vessel corridor study area (Figures in Appendix P.7 display the densities) and some archaeological resources that have not been recorded likely exist. The highest concentration of archaeological resources occur near the Columbia River mouth and the lowest density is near the middle of the corridor close to Longview, Kalama, and Columbia City.

Recorded archaeological resources in the vessel corridor study area include precontact and historic period archaeological resources. The most common precontact archaeological resources include lithic scatters, camps, villages, and burials. Fishing stations, pictographs, shell middens, and house pits are present but fewer in number. Common historic period archaeological resources include commercial properties, structures, and objects. Less common resources include maritime, military, and logging properties, and townsites.

The vessel corridor passes through the Vancouver Lakes Archaeological District.

Eleven TCPs are located within the vessel corridor study area including two ethnographic landforms and nine ethnographic villages (Thorsgard et al. 2013). In addition, the Confederated Tribes of the Grand Ronde and ethnographers have noted a contact period Chinookan village downstream from the proposed Facility site (Fuld et al. 2013, BergerABAM 2014).

The area outside of the 3-nmi limit beyond the Columbia River mouth and into the Pacific Ocean contains very few archaeological resources including shipwrecks and fishing camps.

Historic Resources

The vessel corridor study area contains high concentrations of historic resources (Figures in Appendix P.8 display the densities). The categories of historic resources are similar to those found in the rail corridor study area including residential areas, commercial buildings, historic districts, educational facilities, and religious and cultural facilities. The highest concentration of resources in the vessel corridor study area is in the vicinity of Kalama, Washington, and Astoria, Oregon, where historic districts, residences, and other resources are located in close proximity to the shoreline.

The area outside of the 3-nmi limit beyond the Columbia River mouth and into the Pacific Ocean contains limited historic resources other than lighthouses and historic vessels.

Reserved Treaty Rights

U&A areas for several treaty tribes lie within the vessel corridor, including areas located near Vancouver, Deer Island, Kalama, the Cowlitz River mouth, Longview, Stella, and the Columbia River mouth (Baker Bay) (Butler and Martin 2013, Thorsgard et al. 2013). These areas are used to fish, hunt, and collect treaty resources.

3.13.3 Impact Assessment

3.13.3.1 Proposed Facility

Construction

The proposed Facility study area has no known recorded archaeological or historic resources; therefore, no impacts would occur. No further cultural resources surveys are recommended at the unloading and office area (Area 200), storage area (Area 300), and marine terminal (Area 400). However, archaeological monitoring during construction would occur in the area of the transfer pipelines (Area 500) if the depth of excavation exceeds 10 feet bgs because intact artifact-bearing sediments may be present below 10 feet. The possible relocation of mobile fish and prey species may occur during construction of the proposed Facility to adjacent areas as a result of noise and vibration; such an impact may increase the populations in U&A lands outside the proposed Facility site.

A Cultural Resources Inadvertent Discovery Plan (Flint 2015; Appendix D.14) was developed by the Applicant to identify procedures that would be followed in the event of an unanticipated discovery of cultural resources during construction of the proposed Facility. The steps outlined in the Plan serve to minimize damage to any inadvertently discovered archaeological resources during ground-disturbing activities, which may include small, deeply buried, and/or widely dispersed historic or precontact cultural materials. Steps included in the Plan outline applicable state laws and regulations, previous data collected, stop-work and notification protocols for inadvertently discovered archaeological resources and human remains, discovery protection measures, documentation by professional archaeologists, monitoring of operations and emergency response activities, and notification contact list.

Since in-water work is proposed, potential impacts to U&A areas may occur from reduced access to tribal fishing areas near the proposed Facility marine terminal, resulting in minor impacts. Mitigation for this potential impact has been identified (see Section 3.13.5).

Operations and Maintenance

The proposed Facility study area has no known recorded archaeological or historic resources; therefore, no impacts would occur. Operations and maintenance would not involve ground-disturbing activities, so no unanticipated discovery of cultural resources would occur during operation and maintenance of the proposed Facility.

The addition of one vessel (two trips) per day calling at the proposed Facility may result in minor impacts including a temporary halt to fishing by tribal members in the vicinity when vessels are moving through the area, which could lead to a minor reduction in a day’s catch volume. Mitigation for this potential impact has been identified (see Section 3.13.5).

Decommissioning

The proposed Facility study area has no known recorded archaeological or historic resources; therefore, no impacts would occur. Decommissioning activities are assumed to involve removal of most of the aboveground structures to allow site redevelopment by another tenant. As no additional ground disturbance would occur beyond that carried out for construction, an unanticipated discovery of cultural resources during decommissioning of the proposed Facility is unlikely. Since no in-water work is anticipated during decommissioning, no impacts to U&A areas would occur during decommissioning of upland facilities.

3.13.3.2 Rail Transportation

Archaeological Resources

An increase in the duration of noise and visual interruptions from trains associated with the proposed Facility could impact the setting of archaeological resources both within and outside of Washington. In addition, increased dirt and dust from passing trains could affect the setting of these resources. However, these resources are currently subjected to existing rail traffic along existing rail lines, so these impacts are considered minor.

Increases in the duration of noise and visual interruptions and dirt and dust from passing trains associated with the proposed Facility could impact the setting and use of TCPs by Indian tribes both inside and outside of Washington. However, as TCPs are currently subjected to existing rail traffic along existing rail lines, these impacts are considered minor.

Impacts to archaeological resources outside of Washington would be similar to those inside of the state. Since historic resources are currently subjected to existing rail traffic along existing rail lines, impacts to historic resources outside of Washington are considered minor.

Historic Resources

Impacts to historic resources from trains associated with the proposed Facility include damage to structures from increased dirt and dust from passing trains. Many historic resources in the rail corridor study area are bridges, tunnels, and other features of the existing rail system. As such, increased use could degrade these rail facilities, necessitating more frequent repairs and limitations on use during repairs. Increased limitations on access to some historic resources during gate closures could occur from increased gate downtimes from passing trains associated with the proposed Facility. Increases in the duration of noise and visual interruptions and dirt and dust from passing trains could impact the historic setting of historic resources. However, as trains are part of the existing setting, these impacts are considered minor.

Impacts to historic resources outside of Washington would be similar to those inside of the state. As historic resources are currently subjected to existing rail traffic along existing rail lines, impacts to historic resources outside of Washington are considered minor.

Reserved Treaty Rights

U&A fishing and hunting areas for several treaty tribes are located near the inbound rail route, and an additional four trains per day using the inbound rail route could reduce access to U&A areas in places with at-grade crossings, including gillnet sites, boat launches, and fishing fleets in or near the Columbia River. There are no at-grade crossings on or near tribal reservation lands along the inbound rail route, so access impacts would not occur in those areas. Treaty resources could also be impacted if the increase in rail traffic impacted water quality or hunting and fishing resources. However, the increase in train traffic associated with the proposed Facility is not expected to have any measurable impact to water quality, vegetation, or aquatic habitat or species (see Sections 3.3, 3.4, and 3.6). Impacts to terrestrial wildlife are expected to be minor (see Section 3.5). Access impacts to tribal resources from an increase in train traffic associated with the proposed Facility are also expected to be minor.

3.13.3.3 Vessel Transportation

Archaeological Resources

An increase in vessel traffic and associated wakes and waves could increase shoreline erosion, which could cause degradation, destruction, or loss of archaeological resources located in susceptible areas along the shoreline. Areas vulnerable to wave erosion include reaches with actively migrating channel margins and some of the more confined valley sections, but they are not extensive. Impacts to archaeological sites would depend on the location, shoreline type, and type of archaeological site. Since archaeological resources are currently subjected to existing vessel-related disturbance, impacts caused by one additional vessel (two trips) per day are generally considered minor and may include increased erosion of shoreline sites that are more fragile (such as campsites, shell middens, and rock art). Mitigation measures identified in Section 3.6.5 to reduce impacts to aquatic species from wake stranding would also reduce this potential impact to cultural resources.

Increases in wakes, waves, and noise and visual interruptions associated with increases in vessel traffic could impact the setting and use of TCPs by Indian tribes. However, since TCPs are currently subjected to existing disturbances caused by vessel traffic, impacts caused by one additional vessel per day are considered minor.

As very few archaeological resources exist in the vessel study area seaward of the 3-nmi boundary beyond the Columbia River mouth, no impacts to archaeological resources are anticipated to occur.

Historic Resources

Impacts to historic resources along the vessel corridor may include more frequent noise from increases in the number of vessels passing such resources; however, some shoreline areas would not perceive the noise and all historic resources along the vessel corridor study area shoreline are currently subject to existing vessel traffic.

As very few historic resources exist in the vessel study area seaward of the 3-nmi boundary beyond the Columbia River mouth, no impacts to archaeological resources are anticipated to occur.

Reserved Treaty Rights

The addition of one vessel (two trips) per day through the vessel corridor may result in minor impacts including a temporary halt to fishing by tribal members in the vicinity when vessels are moving through the area, which could lead to a minor reduction in a day’s catch volume. Vessel traffic would not likely affect tribal resources outside of the navigation channel since vessels would not use these areas. However, vessel operations could exclude tribal fishers from a portion of their typical fishing areas within the navigation channel. Vessel traffic could also reduce access to nearshore marine fisheries because tribal fishers may not be able to cross the bar at the time of a vessel moving into or out of the navigation channel, resulting in minor impacts. Mitigation for this potential impact has been identified (see Section 3.13.5).

The increase in one vessel (two trips) trip per day could impact tribal resources if it were to degrade water quality through leaks from routine operations and maintenance; however, this impact would be minor (see Section 3.3). Access impacts to tribal resources, including aquatic habitat, vegetation, and marine and terrestrial wildlife, are expected to be minor (see Sections 3.4 through 3.6).

The area outside of the 3-nmi limit beyond the Columbia River mouth and into the Pacific Ocean contains few U&A resources including fish and sea mammal species. These offshore areas are currently subjected to vessel traffic that is dispersed over a large area, and vessel traffic associated with the proposed Facility would likely be indistinguishable from existing vessel traffic in this area, resulting in minor impacts to reserved treaty rights.

3.13.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant’s request to construct and operate the proposed Project at the Port, and the following impacts to cultural resources from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no impacts to archaeological or historic resources or to reserved treaty rights.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. In the event that the same areas are used for a different facility, no impacts are expected to archaeological or historic resources or to reserved treaty rights under the No Action Alternative as no such resources exist at the proposed Facility site. In the event that a new facility was constructed on sites beyond the boundaries of the proposed Facility, impacts to cultural resources could occur if such cultural resources were present in these areas.

3.13.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to historic and cultural resources in this Draft EIS. EFSEC has identified the following additional mitigation measure to reduce impacts to historic and cultural resources:

- EFSEC will work with Indian tribes to obtain information on particularly sensitive fishing windows and to determine access points and travel routes to U&A fishing grounds along the rail and vessel routes to and from the Port from the Washington-Idaho border to the mouth of the Columbia River. This information will be used to assess whether unit train or vessel timing restrictions should be or could be implemented to reduce impacts to U&A access points and travel routes during certain times of the year.

3.13.6 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to archaeological and historic resources or tribal treaty rights have been identified.

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3.14 TRANSPORTATION

This section describes the traffic and transportation resources at the proposed Facility site and Project vicinity, including roadways, rail, and marine transportation infrastructure that could be affected by Project implementation. This section also discusses impacts to transportation systems related to the transportation of crude oil to and from the Facility. The impacts of Facility construction, operation, and decommissioning on these resources are assessed, and measures to mitigate such impacts are presented. Figure 3.14-1 shows the location of the Facility-related transportation components addressed in this section, namely public and private roads in the Project vicinity that have the highest likelihood of being affected by Facility-related road traffic, the rail loops to be constructed at Terminal 5, and the location of Berths 13 and 14, which would receive marine vessels.

3.14.1 Methods of Analysis

Roadway-related impacts were evaluated based on standards, guidelines, and procedures published in the following documents:

- *Traffic Study Guidelines* (City of Vancouver 2012)
- *A Policy on the Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials 2011)
- *Highway Capacity Manual* (TRB 2000)
- *Manual on Uniform Traffic Control Devices* (FHWA 2009)

The Applicant prepared a Project-specific Transportation Impact Analysis that incorporated applicable standards, guidelines, and procedures contained in the documents listed above. The Transportation Impact Analysis included traffic counts, intersection capacity analyses, and an evaluation of traffic safety conditions (Kittelson & Associates, Inc. 2014). In addition to traffic data collected in the field, the Transportation Impact Analysis included traffic count data assembled by WSDOT and presented online on the "WSDOT Traffic Volume Map" (WSDOT 2014a). The Transportation Impact Analysis was determined by EFSEC and Cardno to be adequate for the purposes of analyzing Project traffic-related effects.

The Applicant prepared an analysis of rail impacts based on data assembled from the Washington State Rail Plan (WSDOT 2014b) and from Cambridge Systematics (2007). The analysis of rail impacts focused primarily on existing train volumes and the capacity of affected rail corridors to accommodate projected additional demand from trains associated with the proposed Facility. The Applicant also prepared an assessment of the estimated closure time for rail-roadway at-grade crossing gates[1] for selected rail corridors (BergerABAM 2014). Appropriate information contained within the Applicant-prepared analysis of rail impacts was used in the preparation of this Draft EIS.

1 At-grade gates occur at the intersection of roads and railways to prevent vehicles from crossing the rail lines when a train is passing.

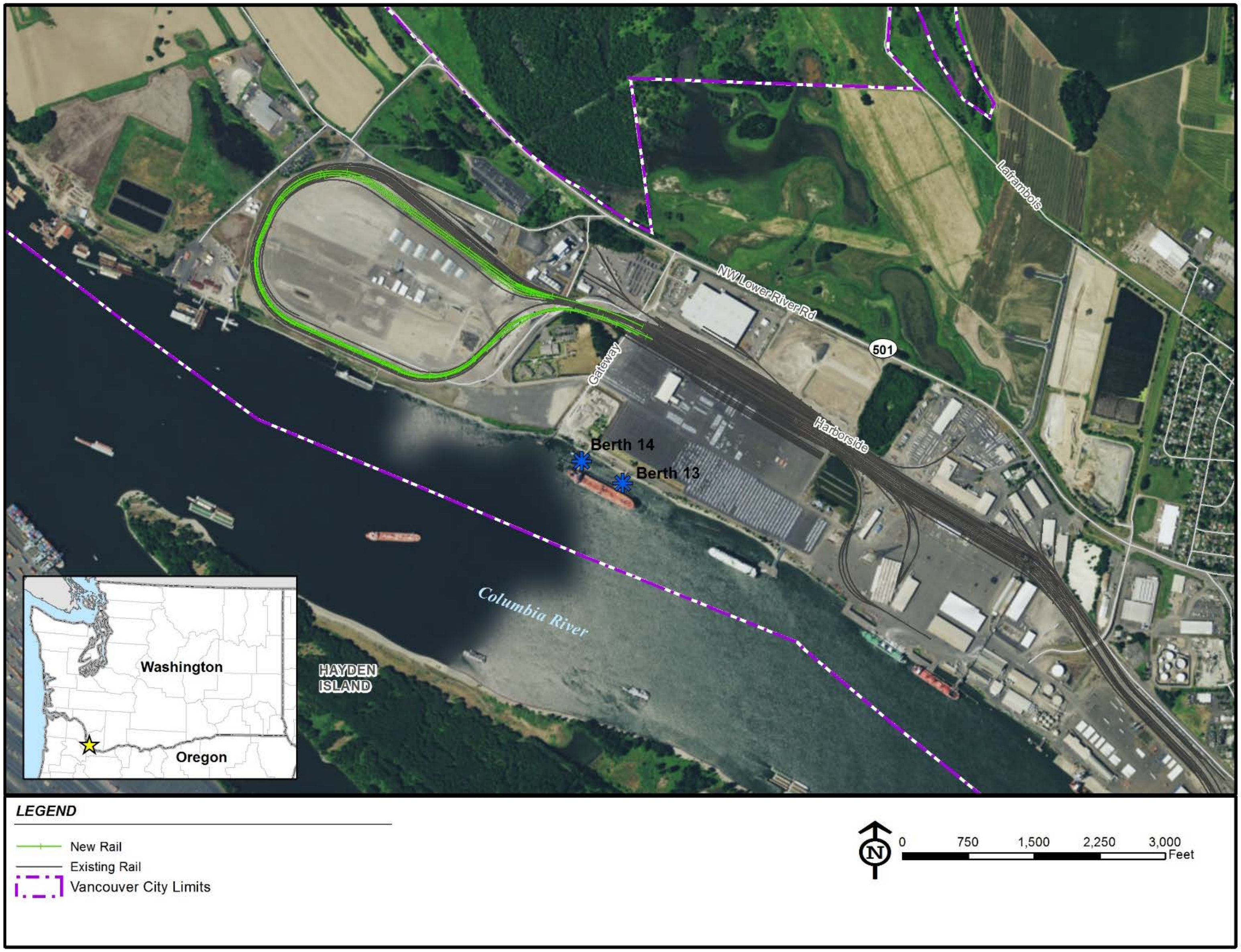

Figure 3.14-1. Principal Transportation Components of the Proposed Action

The Applicant assessed impacts relative to vessel traffic based on a vessel traffic risk analysis performed by WorleyParsons (2014). That analysis identified physical capacity constraints with respect to vessel operations (i.e., navigable waterway infrastructure, berth availability, and terminal operations) and considered potential risks to vessel and terminal operations resulting from the proposed Facility. Appropriate information contained within the Applicant-prepared vessel traffic risk analysis was used in the preparation of this Draft EIS.

The study area for the quantitative transportation analysis in this Draft EIS includes roadway intersections, railroad mainlines, rail-roadway at-grade crossings, maritime navigation routes, and marine terminal facilities. The geographic scope of the study area includes Port of Vancouver Terminal 5 (including internal roadways, rail facilities, and Berths 13 and 14); roadway intersections that provide access to and from Terminal 5; and two regional rail corridors in Washington (i.e., the Columbia River Alignment and the Central Return-Stampede Pass Alignment). The qualitative analysis of transportation impacts includes rail lines beyond the Washington border to Williston, North Dakota; the navigable channel of the Columbia River, from Vancouver to 3 nmi beyond the river mouth; and the open ocean beyond the 3-nmi boundary at the Columbia River mouth.

The rail corridor study area for this analysis includes the Columbia River Alignment (for inbound deliveries of fully laden tank cars) and the Central Return-Stampede Pass Alignment (for outbound return trips of empty tank cars) (see Figure 3.14-3). This return route is consistent with BNSF's operations protocol change in 2012 to enhance use of existing capacity by a directional running agreement using Stampede Pass for eastbound empty bulk trains (Ecology 2015).

3.14.2 Affected Environment

3.14.2.1 Proposed Facility

The discussion of surface transportation focuses on roadway characteristics, including traffic volumes, intersection capacity, roadway safety, and roadway safety considerations. The reason for this emphasis is because the proposed Facility is located in an industrial area that does not provide an extensive network of public transit, pedestrian, or bicycle facilities (Kittelson & Associates, Inc. 2014). Access to the proposed Facility would be via passenger vehicles and trucks.

The proposed Facility would be located within several distinct but connected areas at Terminals 4 and 5 of the Port, between SR 501 to the north and the Columbia River to the south (Figure 3.14-2). Traffic associated with the proposed Facility would primarily access the western end of Terminal 5 via SR 501, NW Old Lower River Road, and NW Harborside Drive. A limited amount of site traffic and all construction-related traffic would approach the proposed Facility on NW Gateway Avenue via SR 501 and use a private access road just east of the Farwest Steel Corporation building (Figure 3.14-2).

Key roadways in the Project vicinity include the following:

- **State Route 501.** The City of Vancouver for the most part operates and maintains SR 501 within the incorporated limits of the city. Beginning west of I-5, SR 501 heads west out of the downtown Vancouver area as Mill Plain Boulevard and then transitions into NW Lower River Road, west of the Fourth Plain Boulevard/Mill Plain Boulevard intersection. As Mill Plain Boulevard, the highway operates as a one-way couplet through the downtown area before transitioning into a two-way, five-lane road west of Franklin Street. The roadway has urban design features including landscaped medians, bicycle lanes, and sidewalks. West of the Fourth Plain Boulevard intersection, SR 501 enters a more suburban context, where it reduces to two travel lanes with left-turn lanes provided at major intersections. SR 501 generally has wide paved shoulders and fog line striping for bicycle travel, and a multiuse path exists at intermittent locations along the southern side of the road. Construction of a multipurpose path (for bicyclists and pedestrians) is currently underway that would connect from the intersection of Mill Plain Boulevard/Fourth Plain Boulevard at NW Lower River Road to NW Gateway Avenue. Continued buildout of the Port would prompt extending this path to Flushing Channel.

- **NW Gateway Avenue** is the main entrance to Terminal 5. The roadway is a private road with two travel lanes and partial sidewalks. On-street parking is allowed.
- **Old Lower River Road** leads to the western end of Terminal 5 as it extends south from SR 501. The roadway continues west to provide access to local industrial businesses before it circles back to SR 501 to the northwest. It is a public local road with two lanes of travel, no sidewalks or bicycle lanes, and no on-street parking.
- **Old Alcoa Access Facility Road**[2] extends eastward from the point where the alignment of Old Lower River Road turns from southbound to westbound. This private road has two travel lanes, a posted speed of 15 mph, and no sidewalks. It leads east to the NGL Energy Partners LP propane supply facility and a gate that prevents further travel east. This roadway would serve as the Facility's primary local access road.

Table 3.14-1 provides additional details regarding the characteristics of the roadways discussed above.

Table 3.14-1. Existing Roadway Characteristics

Roadway	Classification	Lanes	Median Treatment	Speed Limit (mph)	Sidewalks	Bicycle Lanes?	On-Street Parking?
Mill Plain Boulevard (SR 501)	Principal Arterial (State Highway Route)	5	Raised	35	Yes	Yes	No
NW Lower River Road (SR 501)[a]	Principal Arterial (State Highway Route)	2-5[b]	None	45-50[c]	No	No	No
Fourth Plain Boulevard	Principal Arterial	3-5	Two-Way Left-Turn Lane	35	Partial	Yes	No
NW Gateway Avenue	Local Public Street	2	None	Not Posted	Partial (east side)	No	Yes
Old Lower River Road	Local Public Street	2	None	Not Posted	No	No	No
Old Alcoa Facility Access Road	Private Street	2	None	15	No	No	No

Source: Kittelson & Associates, Inc. 2014

a NW Lower River Road (SR 501) is both a City-designated Principal Arterial and State-designated Highway Route from Fourth Plain Boulevard to the City Limits, and is a State Highway Route only to the west of NW Gateway Avenue.

b The number of lanes changes from 5 lanes east of 26th Avenue to 2 lanes west of 26th Avenue, with left-turn lanes at major intersections.

c The posted speed changes from 45 mph east of Centennial Industrial Park to 50 mph west of Centennial Industrial Park.

SR = State Route

2 The Old Alcoa Facility Access Road is a private road owned and maintained by the Port. It has no official name and the name used herein is for the purpose of distinguishing it from other area roads.

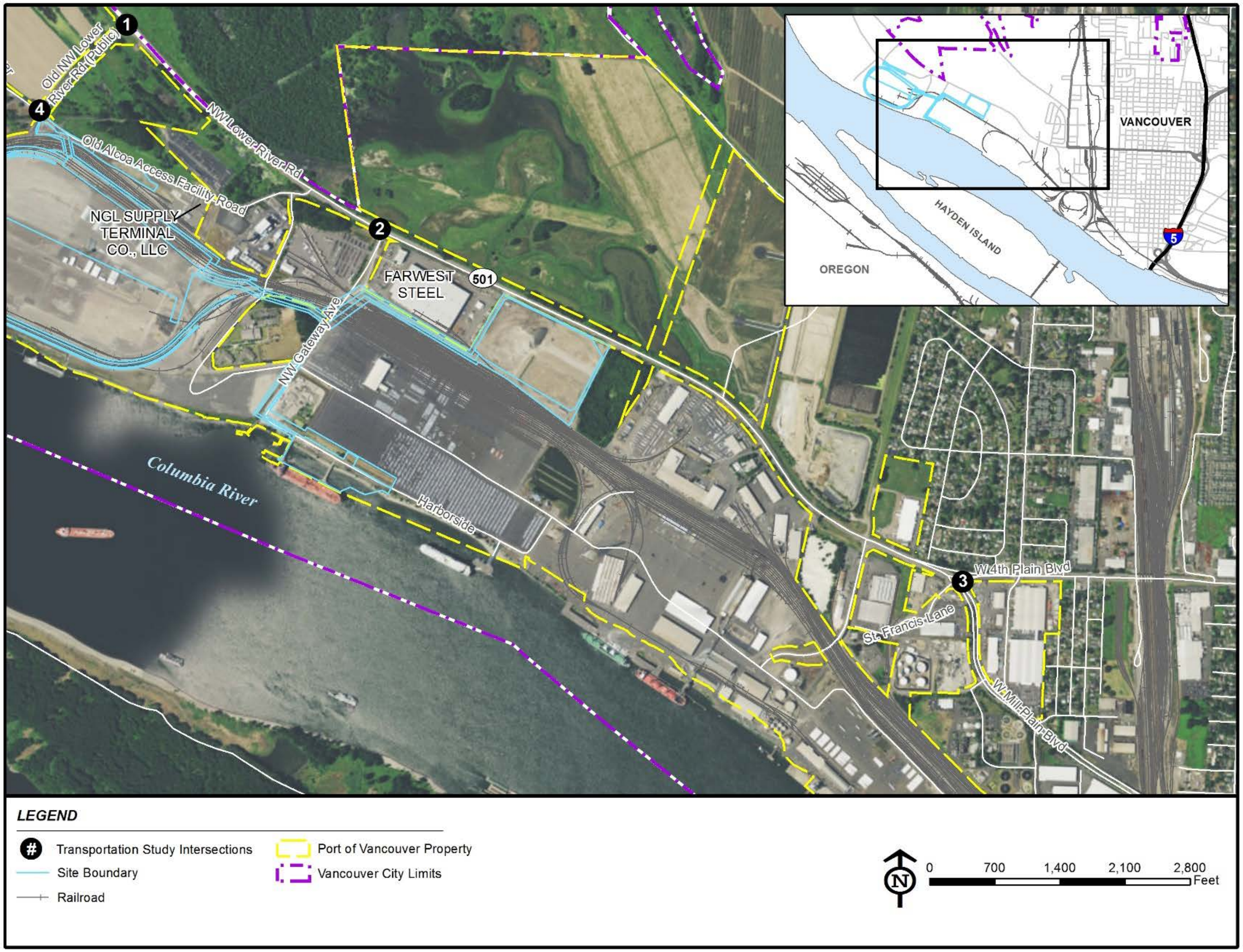

Figure 3.14-2. Existing Surface Transportation Network

Existing Traffic Volumes

Existing Annual Average Daily Traffic (AADT) data for SR 501 were obtained from WSDOT for 2009 through 2012 (Table 3.14-2). The volumes reflect both directions of traffic combined and at locations to the east and to the west of the proposed Facility site.

Table 3.14-2. Historical Average Daily Traffic Counts on State Route 501

Location	Year			
	2009	2010	2011	2012
East of the proposed Facility	4,000	4,000	4,000	4,700
West of the proposed Facility	2,100	2,100	2,000	2,300

Source: WSDOT 2014a

In addition, intersection turning movement counts were conducted at study area intersections in May 2013 during the weekday morning (6:00 to 9:00 am) and afternoon (4:00 to 6:00 pm) peak periods (see Figure 3.14-2 for intersection locations). The counts were compiled and reviewed to identify the peak hours, which occurred from 7:00 to 8:00 am and 4:00 to 5:00 pm. Refer to Appendix L for additional detail on existing intersection turning movement volumes.

Existing intersection lane configurations and traffic control devices at each study intersection are summarized below:

- **Old Lower River Road/State Route 501 (1)** This T-shaped intersection is controlled by a stop sign on the minor street approach of Old Lower River Road; however, the northeast-bound right-turn movement from Old Lower River Road onto SR 501 is channelized with no posted traffic control as it merges with the SR 501 traffic lane. An exclusive left-turn lane is also provided for northwest-bound movements from SR 501.
- **NW Gateway Avenue/State Route 501 (2)** This T-shaped intersection is controlled by a stop sign on the minor street approach of NW Gateway Avenue. An exclusive left-turn lane is provided for northwest-bound movements off the highway.
- **Fourth Plain Boulevard/State Route 501 (3)** This four-legged intersection is signalized and operates with protected left-turn phasing on the mainline approaches of SR 501 and permitted left-turn phasing on the Fourth Plain Boulevard and St. Francis Lane approaches. The traffic signal is isolated and, therefore, not coordinated with other signals along SR 501. Crosswalks with pedestrian signal control are installed on the southwestern and southeastern intersection approaches. Pedestrian movements are not controlled on the other two approaches. The westbound approach on Fourth Plain Boulevard has a free right-turn lane that merges with northbound-to-westbound Mill Plain Boulevard traffic at speed.
- **Old Lower River Road/Old Alcoa Facility Access Road (4)** This four-legged intersection includes the public portion of Old Lower River Road (northern and western legs only), the private portion of the Old Alcoa Facility Access Road (eastern leg), and an outbound-only private driveway coming from the rail loop track area and perimeter road at Terminal 5. Traffic control for each intersection approach leg is as follows:
  - Southbound approach: stop-controlled with a “Right Turn Permitted Without Stopping” sign
  - Northbound approach: stop-controlled

- Eastbound approach: uncontrolled
- Westbound approach: stop-controlled

Existing Level of Service

Roadway and intersection operating conditions, and the adequacy of existing roadway systems to accommodate projected future traffic, are described in terms of LOS ratings. LOS is a method used to rate the performance of streets, intersections, freeways, and other highway facilities. Developed by the Transportation Research Board, and documented since 1965 in various editions of the *Highway Capacity Manual*, LOS rates performance on a scale of A to F, with LOS A reflecting free-flowing conditions and LOS F representing heavily congested conditions (TRB 2000). Table 3.14-3 summarizes the relationship between the average control delay per vehicle and LOS for signalized and unsignalized intersections.

Table 3.14-3. Intersection Level of Service Delay Thresholds

Level of Service	Signalized Intersection Control Delay (sec/veh)*	Unsignalized Intersection Control Delay (sec/veh)*	General Description
A	0 – 10.0	0 – 10.0	Little to no congestion or delays.
B	10.1 – 20.0	10.1 – 15.0	Limited congestion. Short delays.
C	20.1 – 35.0	15.1 – 25.0	Some congestion with average delays.
D	35.1 – 55.0	25.1 – 35.0	Significant congestion and delays.
E	55.1 – 80.0	35.1 – 50.0	Severe congestion and delays.
F	> 80.0	> 50.0	Total breakdown with extreme delays.

Source: TRB 2000

*Control delay includes initial deceleration delay, queue moveup time, stopped delay, and acceleration delay.

In addition to applying LOS as a measure of effectiveness, the City of Vancouver has identified a minimum performance standard based on the intersection's volume/capacity (v/c) ratio. The v/c ratio represents how much of the available intersection capacity is being used by traffic volumes. As the v/c ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. A v/c ratio of 1.0 correlates to LOS E. Once the demand exceeds the capacity (a v/c ratio greater than 1.0), traffic flow is unstable and excessive delay and queuing is expected. A v/c ratio greater than 1.0 equates to LOS F.

The study intersections along SR 501 are subject to WSDOT operational standards that prescribe a minimum performance standard of LOS D or better for signalized and unsignalized (stop sign) intersections. All other study intersections are under the City's jurisdiction and must maintain an LOS E or better and a v/c ratio less than 0.95 for signalized intersections and a v/c ratio less than 0.95 for the critical movement and/or approach for unsignalized intersections.

As Table 3.14-4 shows, all four study intersections currently operate within acceptable operational thresholds during the weekday am and pm peak hours.

Table 3.14-4. Existing Intersection Peak Hour Levels of Service

Location	Control	Peak Hour	LOS	V/C	Standard	Exceeds Standard?
1. Old Lower River Rd/SR 501	Signal	AM	B	0.08	LOS D	No
		PM	A	0.08		No
2. NW Gateway Ave/SR 501	Stop Sign	AM	A	0.06	LOS D	No
		PM	A	0.07		No
3. Fourth Plain Blvd/SR 501	Stop Sign	AM	B	0.55	LOS D	No
		PM	B	0.28		No
4. Old Lower River Rd/Old Alcoa Facility Access Rd	Stop Sign	AM	B	NA	LOS E & V/C ≤ 0.95	No
		PM	A	NA		No

Source: Kittelson & Associates, Inc. 2014

LOS = level of service, v/c = volume/capacity ratio

Existing Traffic Safety

Historical collision data for all four study intersections were assembled for the period between January 2008 and December 2012. Key collision variables (e.g., type, severity) were reviewed at each intersection to assess whether any collision patterns might be identifiable. Table 3.14-5 presents a summary of the 5-year collision history at the study intersections in terms of collisions by type, severity, and per million entering vehicles. The City's *Traffic Study Guidelines* identify a collision rate greater than or equal to 1.0 collision/million entering vehicles as a threshold that determines the need for additional evaluation and potential mitigation. As Table 3.14-5 shows, the study intersections have a collision rate of less than one collision per million entering vehicles. Based on the collision review, and in accordance with City requirements for thresholds exceeding 1.0 collision/million entering vehicles, no apparent safety hazards or safety-based mitigation measures were identified.

Table 3.14-5. Historical Intersection Collision Data Summary (2008-2012)

Intersection	Number of Collisions	Collision Type				Collision Severity		Collisions per Million Entering Vehicles
		Rear-end	Side-swipe	Angle	Overturned Vehicle	Property Damage Only	Injury	
1. Old Lower River Rd/ SR 501	1	--	1	--	--	--	1	0.35
2. NW Gateway Ave/ SR 501	1	--	--	--	1	1	--	0.25
3. Fourth Plain Blvd/ SR 501	4	--	2	1	1	3	1	0.33
4. Old Lower River Rd/ Old Alcoa Facility Access Rd	0	--	--	--	--	--	--	0.00

Source: Kittelson & Associates, Inc. 2014

SR = State Route

Existing Sight Distance

Per City guidelines (VMC Section 11.80.140), public and private streets must comply with the sight distance standards specified in *A Policy on Geometric Design of Highways and Streets Standards* (American Association of State Highway and Transportation Officials 2011). A sight distance analysis for stop-controlled movements at key intersections was undertaken to assess whether or not drivers have adequate intersection sight distance at key intersections in the Project vicinity (Table 3.14-6). All locations currently have adequate intersection sight distance. Appendix L provides additional details regarding the sight distance analysis.

Table 3.14-6 Intersection Sight Distance Analysis

Intersection	Approach	Available Sight Distance (feet)	Minimum Sight Distance	Available Sight Distance < Minimum?
1. Old Lower River Rd/SR 501	northbound	>1,000 westbound and eastbound	555 feet	No
2. NW Gateway Ave/SR 501	northbound	>1,000 westbound and eastbound	555 feet	No
3. Private Access (Farwest Steel)/SR 501	northbound	>1,000 westbound and eastbound	555 feet	No
4. Old Lower River Rd/ Old Alcoa Facility Access Rd	northbound southbound westbound	650 westbound, >1,000 northbound	280 westbound, 610 northbound	No
		550 westbound	280 westbound	No
		650 westbound	280 westbound	No

Source: Kittelson & Associates, Inc. 2014
SR = State Route

3.14.2.2 Rail Corridor

Washington contains more than 3,000 miles of railroad tracks. Rail tracks support the movement of freight and passengers between specific locations as well as between other transportation modes, such as ships, airplanes, and trucks, both within and outside of the state. Rail infrastructure across the state supporting the movement of freight includes main and branch lines, industrial spurs, and railyards, which are operated by a number of carriers. Two of the largest railroad companies operating in Washington are BNSF Railway and Union Pacific Railroad. These companies represent about 60 percent of the state's rail network (by mileage) and transport almost 2 million carloads[3] of freight annually. Together these railroads handle the majority of rail freight that moves into, out of, and within Washington. Amtrak provides intercity and long distance passenger service in Washington on tracks owned by BNSF (WSDOT 2015a).

Figure 3.14-3 illustrates the location of BNSF and Union Pacific rail alignments in Washington and in portions of Idaho and Oregon near the state boundary, including the Columbia River Alignment (inbound delivery route) and Central Return-Stampede Pass Alignment (outbound return route).[4]

3 The quantity of goods that can be carried in a railway freight car.

4 As shown in Table 3.14-7, the Central Return-Stampede Pass route has less rail traffic and, thus, less potential congestion than the Columbia River Alignment (15 to 86 percent utilization compared to 70 to 86 percent utilization, respectively). It is not expected to reach capacity as soon as the Columbia River Alignment. Further, BNSF has implemented a directional running agreement to use the Stampede Pass Alignment for return of empty bulk trains (Ecology 2015).

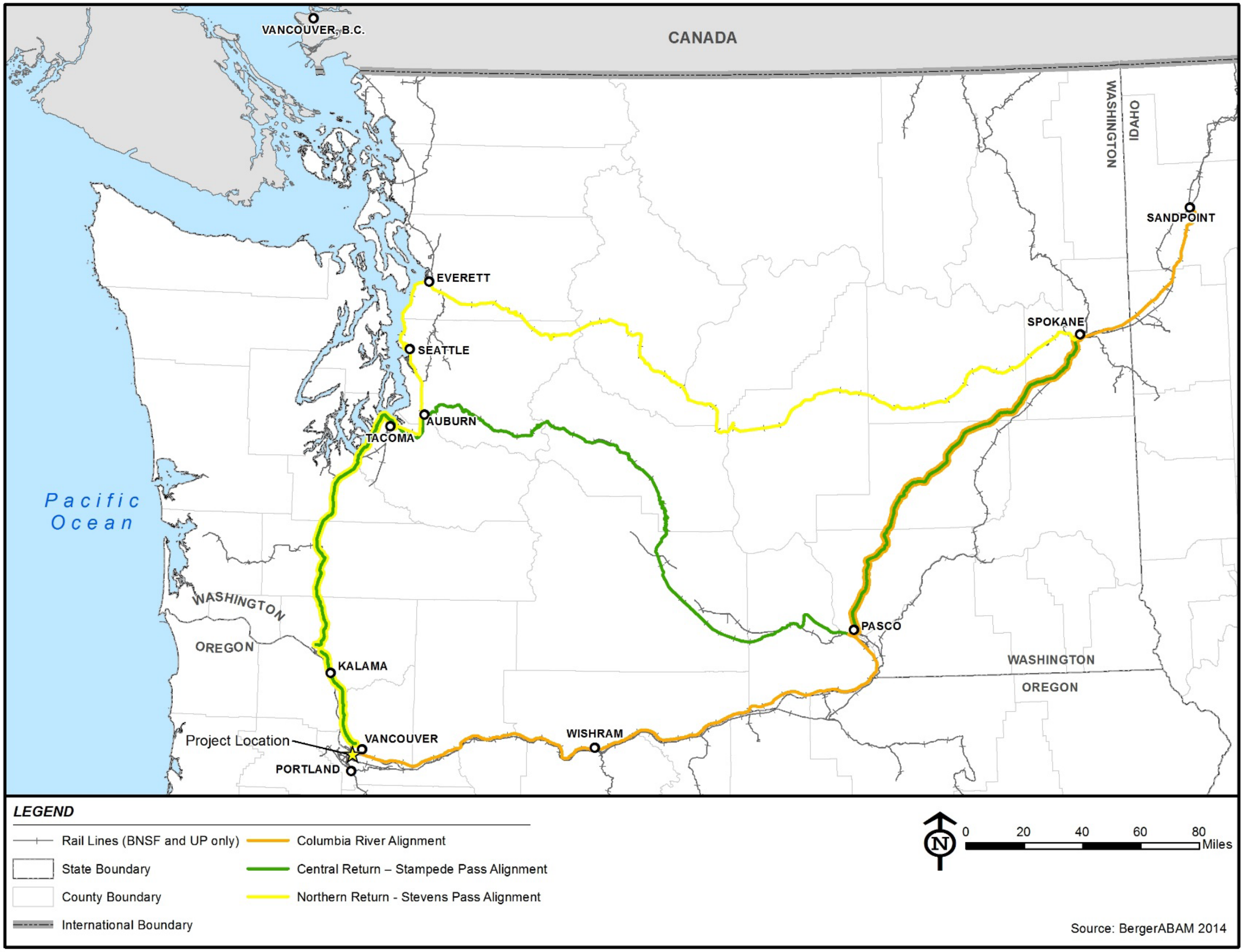

Figure 3.14-3. Rail Alignments in Washington and Neighboring Areas of Idaho and Oregon

Amtrak operates long distance rail passenger service (one daily round trip) between Portland and Chicago (Empire Builder) using the Columbia River Alignment with stops at stations in Vancouver, Bingen-White Salmon, Wishram, Pasco, and Spokane, Washington. Amtrak also operates five daily round trips using the Vancouver to Auburn portion of the Central Return-Stampede Pass Alignment for long distance and intercity passenger service between Seattle and Portland (Amtrak Cascades) and Seattle and Los Angeles (Coast Starlight). Currently there is no rail passenger service operating on the Central Return-Stampede Pass Alignment between Auburn and Pasco. Sound Transit operates regional/commuter passenger service (Sounder) between Tacoma/Lakewood and Seattle (nine daily round trips) using the portion of the Central Return-Stampede Pass Alignment between Tacoma/Lakewood and Auburn (WSDOT 2014c).

Table 3.14-7 identifies the estimated number of trains (passenger and freight) per day, daily capacity, utilization, and track miles for the two rail routes analyzed based on Washington, Oregon, and Idaho rail plans. These data were collected and analyzed by the Applicant (BergerABAM 2014) and use information within the Washington State Rail Plan (WSDOT 2014b). As indicated in the State Rail Plan, the capacity and the number of trains are based on counts and estimates performed in 2010, 2012, and 2013. While the State Rail Plan data provide a reasonable estimate of existing conditions at the time of publication, it is possible that more or fewer trains have been added to the rail segments in Table 3.14-7 in the years since the data were collected. If so, the degree of utilization[5] could be higher or lower than the percentages shown in the table. As noted in the State Rail Plan, the freight train volumes listed are a “snapshot” of existing train volumes, which are dynamic and fluctuate as a result of changing customers and/or demands (WSDOT 2014b).

Table 3.14-7. Volume, Capacity, Utilization, and Miles by Segment and Alignment

<table>
<tr><th>Rail Segment</th><th>Daily Train Volume[a] (Freight-Only Train Volume)</th><th>Daily Track Capacity</th><th>Utilization[b]</th><th>Track Miles</th></tr>
<tr><td colspan="5">Columbia River Alignment Segments</td></tr>
<tr><td>Sandpoint, ID, to east of Spokane, WA</td><td>48 (46)</td><td>74</td><td>65%</td><td>65.5</td></tr>
<tr><td>Spokane, WA</td><td>56 (54)</td><td>76</td><td>74%</td><td>3.5</td></tr>
<tr><td>South of Spokane, WA, to Pasco, WA</td><td>32 (30)</td><td>37</td><td>86%</td><td>149</td></tr>
<tr><td>Pasco, WA, to Wishram, WA</td><td>28 (26)</td><td>40</td><td>70%</td><td rowspan="2">227</td></tr>
<tr><td>Wishram, WA, to Vancouver, WA</td><td>28 (26)</td><td>40</td><td>70%</td></tr>
<tr><td colspan="5">Central Return-Stampede Pass Alignment Segments</td></tr>
<tr><td>Vancouver, WA, to Kalama/Longview, WA</td><td rowspan="2">41 (31)</td><td rowspan="2">78</td><td>53%</td><td>37</td></tr>
<tr><td>Kalama/Longview, WA, to Tacoma, WA</td><td>53%</td><td>100</td></tr>
<tr><td>Tacoma, WA, to Auburn, WA</td><td>41 (13)</td><td>115</td><td>36%</td><td>20</td></tr>
<tr><td>Auburn, WA, to Pasco, WA, via Stampede Pass (and Yakima)</td><td>6 (6)</td><td>39</td><td>15%</td><td>227</td></tr>
<tr><td>Pasco, WA, to Spokane, WA</td><td>32 (30)</td><td>37</td><td>86%</td><td>149</td></tr>
</table>

Sources: BergerABAM 2014, WSDOT 2014b

a The number of freight and passenger trains traveling in both directions by segment. For example, on the segment from Sandpoint, ID, to east of Spokane, WA, the daily train volume of 48 represents a combination of trains traveling in both directions on the track segment.

b The ratio of the daily train volume to daily track capacity.

5 Utilization is defined as the ratio of demand (i.e., daily train volume) to daily track capacity (WSDOT 2014a).

The inbound Columbia River Alignment and outbound Central Return-Stampede Pass Alignment reflect one train route combination. It is possible that outbound trains departing the proposed Facility could use the Northern Return - Stevens Pass Alignment to return to the loading station in Willaston, North Dakota (Figure 3.14-4). As shown in the State Rail Plan, existing utilization on this alignment is similar to the Central Return-Stampede Pass Alignment and would, therefore, have similar effects on rail transportation capacity.

Three variables were used to estimate current capacity of rail segments shown in Table 3.14-7: the number of tracks, the type of control system, and the mix of train types. As shown in the table, all study segments currently operate within acceptable operational thresholds and have sufficient capacity for the existing daily train volume presented in the State Rail Plan. However, the segment from south of Spokane to Pasco is currently operating near capacity with a utilization rate of 86 percent.

BNSF data indicate that from January to July 2014, BNSF shipped a total of 1,169,414,400 gallons (approximately 28 million bbl) of crude oil in Washington. This amount represents approximately 40,000 carloads of crude oil. If this volume of oil was shipped by unit trains comprising 120 cars each, it represents between approximately 309 and 428 trips.[6]

Roadway-Rail Crossings

Numerous public and private roadways cross the rail alignments. At-grade crossings are locations “where a public highway, road, street, or private roadway, including associated sidewalks and pathways, crosses one or more railroad tracks at grade, and is identified by a US Department of Transportation (DOT) National Highway-Rail Grade Crossing Inventory Number, or is marked by crossbuck signs, stop signs, or other appropriate signage indicating the presence of an at-grade crossing” (49 CFR 218.93). Public grade crossings are highway-rail grade crossings where the roadway is under the jurisdiction of and maintained by a public authority (FHWA 2014). Public crossings are typically the responsibility of the local jurisdiction to establish, and the railroad company is responsible for maintenance of the crossing protection. If a local jurisdiction wishes to create an at-grade crossing, they would assume responsibility for construction. Private grade crossings are at-grade crossings where the roadway is privately owned and is intended for use by the owner or by the owner’s licensees and invitees. It is not intended for public use and is not maintained by a public highway authority (FHWA 2014).

At-grade crossings require nontrain traffic to defer to the passing train (FHWA 2007) and include warning devices and protective measures that are classified as either passive or active protection. Passive protection includes signage and pavement markings supplied by local agencies and railroad crossbuck signs provided by the railroad. Active protection includes signals, bells, gates, or other devices and methods that inform the public of approaching trains. The majority of active protection devices are automatically activated by an approaching train (WSDOT 2012). Some of the rail alignment crossings are grade-separated. At these locations, the rail line and roadway are separated vertically (either rail or railroad passes over or under the other), and no conflict exists between the two modes of transportation.

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6 Each railcar has a crude oil capacity of between 650 and 750 bbl, with a total unit train capacity ranging between 65,000 and 90,000 bbl.

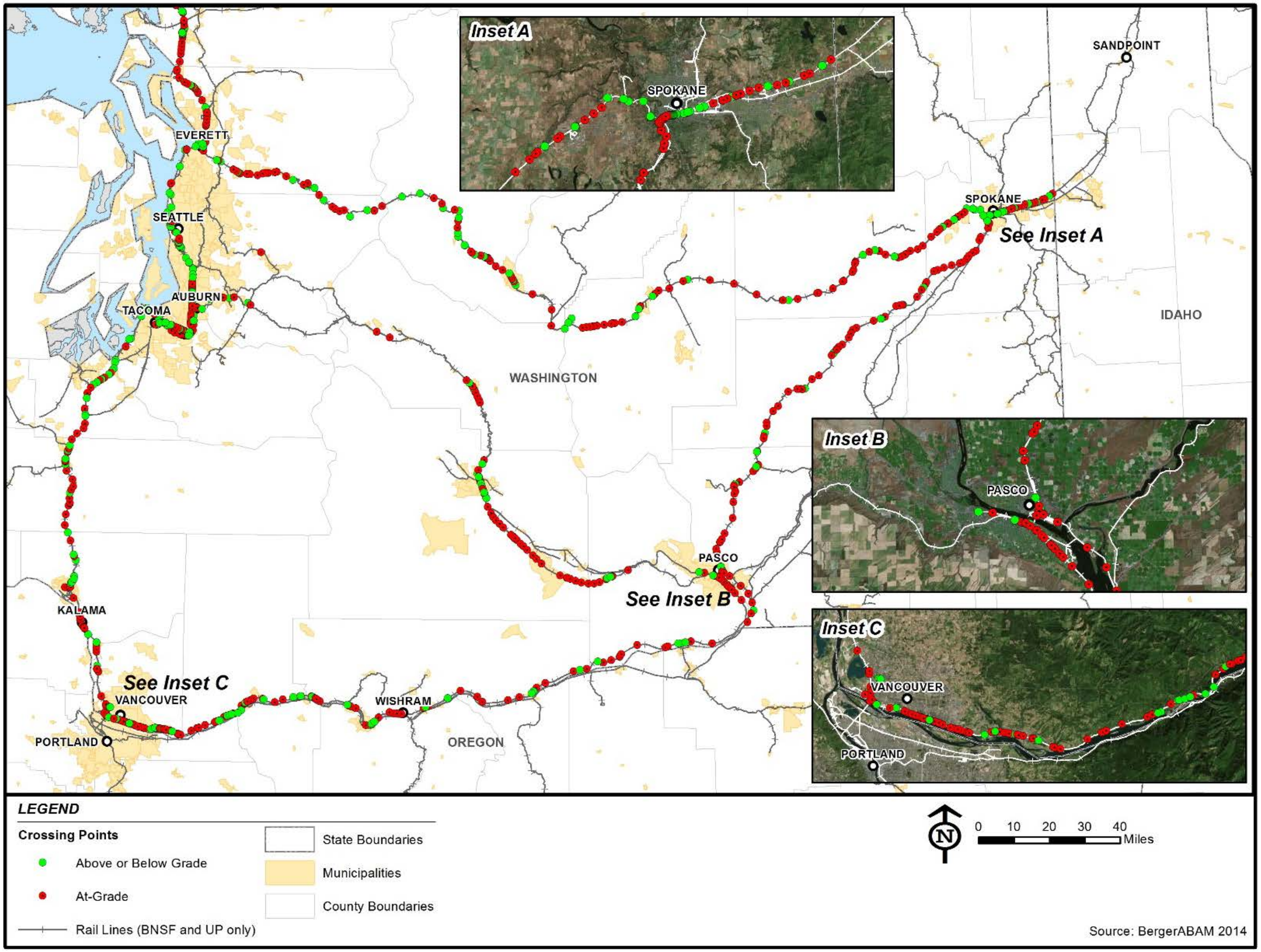

Figure 3.14-4. At-Grade Rail Crossings along the Columbia River, Northern Return, and Central Return Alignments in Washington

Along the Columbia River Alignment in Washington are 200 at-grade public crossings, plus numerous other crossings on both the Central Return and Northern Return Alignments (Figure 3.14-4). Of the 200 on the Columbia River Alignment in Washington, 186 are included in the National Highway-Rail Grade Crossing Inventory database (FRA 2015), and 14 were identified based upon a review of aerial photography. On average, the Columbia River Alignment has an at-grade crossing every 2.2 miles. The number of crossings is an important consideration, given that many communities are bifurcated by rail lines, and that local access and circulation may be affected by rail traffic, especially in cases where alternate routes to cross the tracks do not exist.

The DOT database includes data on the types of warning devices in use at some of the at-grade crossings. Where data are provided (for 132 of the 186 crossings), approximately 68 percent of the crossings included some form of active protections (e.g., flashing lights or gates), while the remaining 32 percent included passive measures only (e.g., stop signs, crossbucks, or no sign or signal) (FRA 2015).

At-Grade Crossing Delays

Delays experienced by motorists at any particular at-grade crossing depend on the traffic volume of both the roadway and track segment, as well as the length and speed of trains using these crossings. These factors in turn depend on the type and weight of trains going through as well as the characteristics of a particular crossing (track, signals, barriers, and highway approaches, among others). The combined delay experienced by motorists may also be influenced by the time of day that the train passes through. For example, if a train moves through a crossing during peak traffic commuting periods (such as 7:00 to 9:00 am and 4:00 to 6:00 pm), when vehicular traffic volumes are typically at their highest, more motorists would be expected to experience delays than if the train passed through outside of the peak commuting periods, when volumes are lighter.

One method of measuring delays caused by train movements is to estimate “gate downtime,” the period during which the active protection (the crossing gate) is in place and, thus, requiring roadway users to stop. Gate downtime does not include other types of delay that could occur at at-grade crossings, including the deceleration of cars and other vehicles as they approach a lowered gate and the acceleration of stopped vehicles and the clearance of queues after the gate is raised. The data used for the gate downtime analysis in this EIS are presented in Appendix M. Key assumptions for this analysis include:

- Freight trains are assumed to be 7,800 feet long on average and would pass through at-grade crossings at an average speed of 20 mph[7] (BergerABAM 2014).
- Gate downtime is estimated to begin with the gate closing 30 seconds before the train arrives (the minimum is 20 seconds) and the gate opening 12 seconds after the train passes (per regulations).

Table 3.14-8 summarizes the total gate downtime[8] per day by segment within the Columbia River Alignment caused by existing passenger and freight rail crossings. As shown, the average gate downtime per crossing per day is between 2.3 and 4 hours. The delay experienced by an individual driver at a given at-grade crossing would depend upon the length of the train, its speed, and at what point in the gate closure/opening process the vehicle arrived. If a motorist were to arrive at the moment the gate began to be lowered for a 7,800-foot-long train traveling at 20 mph, that motorist would be delayed for just over

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7 Although allowable speed varies along the rail route alignments based on land use type and intensity, rail alignment grade, and curvature, the speed of 20 mph was selected to provide a reasonably conservative analysis and consistency of results along the entire route alignment.

8 For controlled at-grade crossings only. Although not included in this analysis, motorists would also experience delay at uncontrolled crossings. The delay for an individual train would be lower than at an uncontrolled crossing, as no additional time is spent lowering and raising the gate.

5 minutes. However, since drivers would approach the crossing at different times during the closure and opening process, the average delay would be 2 minutes 30 seconds (2:30) per motorist per train at each crossing.

Table 3.14-8. Gate Downtime along the Columbia River Alignment, by Segment

Segment	Gate Downtime per Day	
	Minutes	Hours
Between Idaho and Spokane	240	4.0
Between Spokane and Pasco	158	2.6
Between Pasco and Wishram	138	2.3
Between Wishram and Vancouver	138	2.3

Source: BergerABAM 2014

BNSF Inspection Programs

BNSF has implemented various safety programs and systems involving inspection, detection, and monitoring, as described in the following paragraphs (BergerABAM 2014):

Track Inspection Programs

Most of BNSF's key routes are inspected four times per week and the busiest main lines are inspected daily (BNSF 2015). Track inspections focus on identifying rail defects present in rail gauge, switches, ties, rail, and grade crossings. They include methods such as ultrasound, eddy current inspection (for surface flaws and near-surface flaws), magnetic particle inspection (for detailed manual inspection), radiography (used on specific locations [often predetermined] such as bolt holes and where thermite welding was used), magnetic induction or magnetic flux leakage (used to locate flaws difficult to observe visually), and electromagnetic acoustic transducers. BNSF performs inspections twice a year on all bridge structures. Bridges identified for extensive work or replacement receive an additional inspection by a structural engineer. The inspections also identify required maintenance. Underwater foundation inspections are conducted using imaging equipment and divers. Moveable bridges are inspected for mechanical, structural, electrical, and signal compliance.

To assess and prioritize track surfacing, dedicated track geometry cars traverse the BNSF network on an ongoing basis collecting data about the condition of the 32,000-mile network. The data are processed to develop a Track Quality Index rating for every 0.25-mile segment of the network, which is used to prioritize surfacing investment over time. BNSF's track geometry cars measure rail wear in real time and provide an exception list to maintenance personnel for field verification, who use this information for planning and to take remedial action. BNSF planned to replace approximately 419 track miles of curve rail and 614 track miles of tangent rail in 2014 (BergerABAM 2014).

Weather Monitoring and Earthquake Inspection Programs

BNSF's safety processes include preparation for impacts that natural disasters could have on rail infrastructure. Inspections to identify potential rail and track damage are performed following extremely hot and cold weather conditions, storms, high-water periods, and earthquakes. BNSF's Network Operations Center in Fort Worth is linked to WeatherData Services, Inc., to obtain advance warnings of adverse weather that might affect rail operations. The service monitors weather conditions on its network 24/7 and issues severe weather alerts to BNSF to enable dispatchers to bring trains to a stop when severe local weather conditions, such as tornadoes, very high winds, or flash flooding, could pose a threat to train movements. When wind warnings are received that indicate possible wind speeds of 51 to 60 mph, BNSF instructs passenger trains to reduce speed to 40 mph. For wind warnings of possible wind speeds in excess of 61 mph BNSF instructs passenger trains to stop. Depending on the type of freight trains in the area, some freight trains must come to a stop if wind speeds exceed 51 mph (BergerABAM 2014).

The center also has a direct link to the California Institute of Technology for real-time updates about earthquake activity. When a significant earthquake is reported, BNSF inspects track based on the earthquake's magnitude and epicenter location. BNSF's policy requires inspecting track if the earthquake is measured at 5.5 magnitude or higher on the Richter scale. The required inspection radius is determined by the location of the epicenter (BergerABAM 2014).

Slide Fence Detectors

BNSF monitors areas adjacent to its tracks for susceptibility to rockfall and landslides that could affect track operations. When vulnerable areas are identified, BNSF places slide fence detectors in potential slide areas. The electrified fences send a signal to the BNSF train dispatch system if fence failure is detected. When contact is made with the fences, a red block signal indication is displayed to provide advanced warning to approaching trains (BergerABAM 2014).

Rail Facilities at the Port of Vancouver

The Port is located at the crossroads of Washington's major north-south (I-5 corridor) and east-west (Portland to Pasco) rail lines. BNSF owns and operates these rail lines, although it shares operating rights over a portion of the I-5 corridor line with Union Pacific. The Port provides rail access that extends from the main rail lines just west of I-5, continuing to and circulating through the Port, and extending eastward into the proposed Facility site. Terminal 5 contains multiple rail lines serving existing Port tenants and activities.

As part of the ongoing West Vancouver Freight Access (WVFA) project, 37,450 feet of new Terminal 5 tracks have been constructed and 6,300 feet of track have been relocated since 2010 to handle unit trains up to 8,400 feet in length; significantly reduce delays on main north/south and east/west rail lines; and enable the Port to more competitively handle a wider range of commodities (Port of Vancouver 2015). In addition to the WVFA project, the WSDOT Vancouver Bypass Project, a passenger rail improvement, is underway. When both projects are complete, a 40 percent reduction in delays (over 2005 congestion) will be realized at the Vancouver Wye, a critical juncture in the mainline rail system (WSDOT 2015b).

Three rail loops (4102, 4105, and 4107) currently exist at Terminal 5 that facilitate the transit of freight trains into and out of Terminal 5. These loops primarily serve operations of existing transloading operations conducted at the Port. The WVFA project is shifting tracks 4105 and 4102 further outward and constructing an additional loop track (4106) (see Section 2.2.2.1 for additional details). A limited number of private at-grade crossings allow entry of motor vehicles into Terminal 5 across these existing loop tracks.

Figure 3.14-5 shows 4 at-grade crossings and 11 grade-separated roadway-railroad crossings along the main BNSF delivery and return routes to the Port. Numerous WVFA grade separation projects along the BNSF mainline, including the recently completed "trench" project, which created a new rail entrance to the Port, have substantially reduced the number of at-grade crossings in Vancouver, thereby improving safety and reducing vehicle delays.

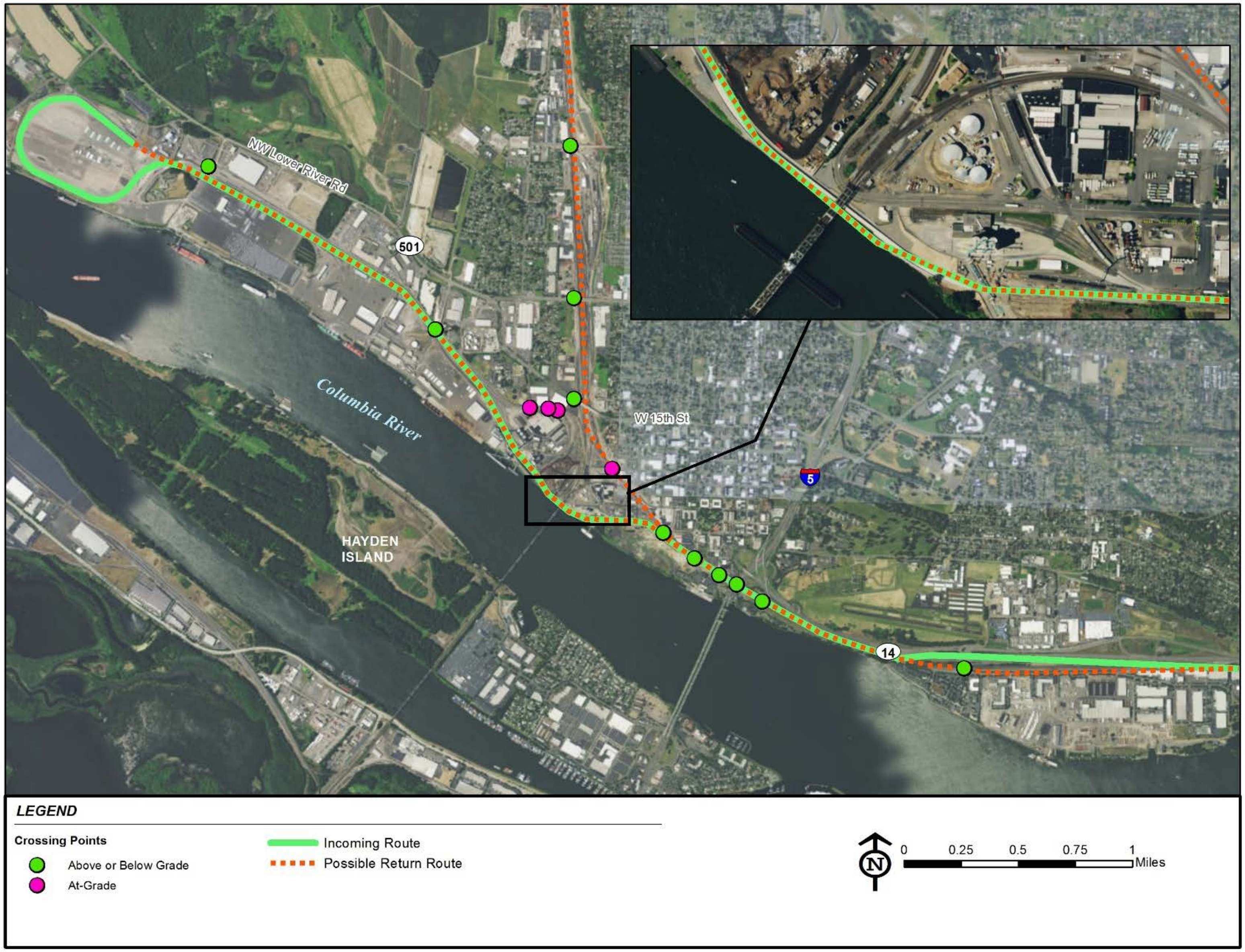

Figure 3.14-5. Existing Roadway-Rail Crossings near the Proposed Facility

Freight rail traffic is very dynamic and does not adhere to a set schedule the way passenger trains do. The volume of rail traffic, trains handled per day, and the routing of each train vary based on customer needs, train length, weather, freight volume, and market demands for the commodity handled. Figure 3.14-5 shows one possible route for empty oil tank cars to return to the point of origin: empty tank car sets would be backed onto the Fallbridge Subdivision and then their direction would be changed to traverse the I-5 Subdivision up to the node at Auburn. While this route would be the most likely, other return routes exist to transport empty tank cars to the point of origin. One other possible scenario may be to take empty tank cars back on the Fallbridge Subdivision to Pasco/Spokane (Edberg, pers. comm., 2015). It should be noted that currently, three to four loaded unit trains per day travel through the City of Vancouver using the Fallbridge and I-5 Subdivisions to deliver crude oil to refineries and marine terminals in Bellingham, Ferndale, Anacortes, and Tacoma, Washington (Ecology 2015).

Figure 3.14-6 represents the railcar counts handled at the Port by year from 1994 to present. In terms of railcars handled, volumes at the Port peaked in 2007 with more than 57,000 railcars handled that year. This peak was followed by the recession, which resulted in a reduction in volume that has only recently started to increase.

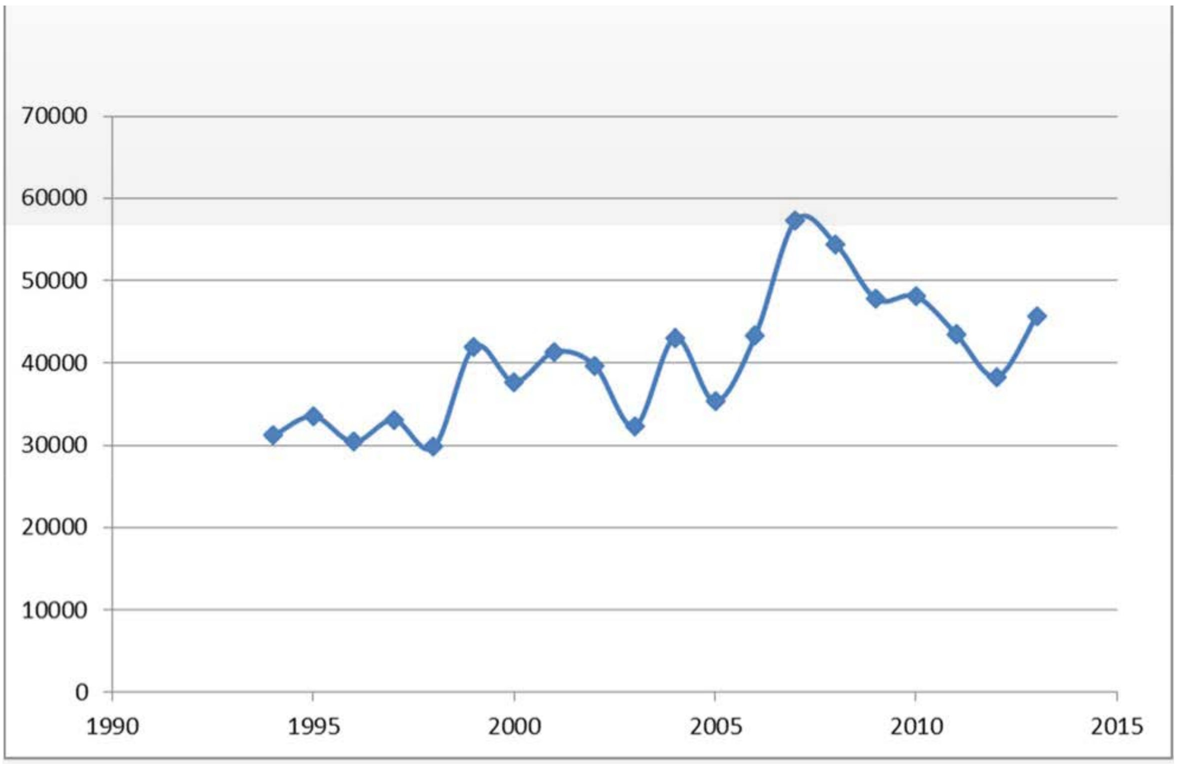

Figure 3.14-6. Port of Vancouver Railcar Counts, 1994–2013

Source: BergerABAM 2014

3.14.2.3 Vessel Corridor

The Port of Vancouver is one of six major ports in Washington and Oregon that lie along the Columbia River. Deep-draft vessels that call on the Port include general cargo vessels, tankers, barges, and roll-on/roll-off vessels (including pure car carriers). Vessels traveling to and from the Port comingle with other vessels in the Columbia River navigation channel destined for the other five ports, four of which are located between Vancouver and the Pacific Ocean. Deep-draft vessels calling on the other ports include the same types of vessels at the Port, plus cruise ships, naval vessels, log ships, dry bulk carriers, and container carriers. Typical commercial vessels transiting the Columbia River have weights ranging from 11,000 to 53,100 tons and drafts ranging from 20 to 50 feet (WorleyParsons 2014).

Crude oil handled by the proposed Facility would be loaded on to marine vessels for transfer to receiving refineries along the West Coast of the United States and Canada. Marine vessels serving the Facility would use the Columbia River to access the Pacific Ocean. The Columbia River navigation channel operates similar to a two-lane highway. Unlike Puget Sound or San Francisco Bay, which have many combinations of routes that vessels entering and exiting may use, an inbound or outbound vessel can use only one pathway through the Columbia River navigation channel. From the mouth of the Columbia, vessels would travel on ocean navigation routes north, south, or west depending on their destination. The proposed Facility could serve multiple refineries and terminals. Destinations could include refineries in Alaska, Hawaii, California, and Washington. No destinations are anticipated in Oregon because Oregon has no refineries. Refer to Section 2.7 for additional details on vessel operations and the Columbia River navigation channel.

3.14.3 Impact Assessment

3.14.3.1 Proposed Facility

Construction

Surface Transportation

Approximately 149 construction workers are expected to be present during the peak Facility construction period of approximately 18 months. This number translates into 298 estimated daily vehicle trips (i.e., one inbound and one outbound per day), assuming a construction schedule of one shift for all construction workers and an occupancy of one person per vehicle. As a result, 149 vehicle trips were assumed to arrive during the am peak hour period and depart during the pm peak hour period. In addition to construction worker trips, the Proposed Action is expected to generate 344 daily trips for the delivery of construction equipment and materials, including 32 each in the am and pm peak hours (Kittelson & Associates, Inc. 2014). As shown in Table 3.14-9, the construction activities would involve a total of 642 daily trips, including 181 in both peak hours.

Table 3.14-9. Construction Traffic Generation

Trip Type	Number	Daily Trips	Weekday AM Peak Hour			Weekday PM Peak Hour		
			Total	In	Out	Total	In	Out
Construction Workers	149 Employees	298	149	149	0	149	0	149
Truck Deliveries	172 Deliveries	344	32	16	16	32	16	16
Total		642	181	165	16	181	16	165

Source: Kittelson & Associates, Inc. 2014

The Proposed Action’s traffic effects on peak hour intersection LOS were analyzed using the procedures described in Section 3.14.1 and in Appendix L. Table 3.14-10 presents the results of this analysis. As shown, while construction-related traffic would increase v/c at most intersections, it would not result in a change in LOS, or cause the applicable performance standard (i.e., LOS or v/c) to be exceeded. Therefore, construction-related impacts to roadways are expected to be minor.

The shifting of rail loops (described below) would be accomplished within the footprint of the existing rail loops and the associated access road present on Terminal 5. To accommodate shifting of the rail loops, the Port would reduce the width of the access road from 24 to 13 feet and reduce the distance between rail lines from 21 to 15 feet. These developments are not expected to negatively impact roadway or rail operations.

The realignment of the natural gas pipeline presently located where the boiler building would be constructed would take place within an existing private roadway on the northern side of the office and unloading area (Area 200) and the boiler building (Area 600). Realignment of the line would involve a temporary reduction in capacity on this roadway and necessitate the detour/diversion of traffic during the 18-month construction period, with detours resulting in minor impacts to traffic along this section of roadway.

Table 3.14-10. Intersection Peak Hour Levels of Service, with Construction Traffic

Location	Control	Peak Hour	Existing		Existing Plus Construction		Standard	Exceeds Standard?
			LOS	V/C	LOS	V/C		
Old Lower River Rd/SR 501	Signal	AM	B	0.09	B	0.10	LOS D	No
		PM	B	0.31	B	0.32		No
NW Gateway Ave/SR 501	Stop Sign	AM	A	0.06	A	0.06	LOS D	No
		PM	B	0.09	B	0.40		No
Fourth Plain Blvd/SR 501	Stop Sign	AM	B	0.65	B	0.72	LOS D	No
		PM	B	0.32	B	0.39		No
Old Lower River Rd/Old Alcoa Facility Access Rd	Stop Sign	AM	C	NA	C	NA	LOS E & V/C ≤ 0.95	No
		PM	A	NA	B	NA		No

Source: Kittelson & Associates, Inc. 2014

LOS = level of service, v/v = volume/capacity ratio

Rail Transportation

As described in Section 2.2.2.1, as part of the proposed Facility, the Applicant would relocate approximately 1,500 feet of tracks 4106 and 4107 to allow for track tie-ins into the railcar unloading facility in Area 200, for release of tank cars back to the main track from the railcar unloading facility, and to separate tank cars in need of repair or further inspection from the remainder of a unit train (BergerABAM 2015). As part of the proposed Project, the Port would grant the proposed Facility exclusive use of tracks 4106 and 4107 and the Applicant would construct a new approximately 4,900-foot-long loop track (4101) on the outside of the existing loop tracks (Figure 2-3). Construction of this new track (4101) would reduce the width of the existing inspection road on the outside of the track from 24 to 13 feet and would require the addition of pullouts to allow vehicle passing. When unloading volumes at the proposed Facility reach and exceed 120,000 barrels per day (bpd), the Port would grant the Applicant exclusive use of track 4105, and at the same time, track 4101 would be transferred to the Port's use and would not be used by the Applicant (Harding, pers. comm., 2015). The Applicant's relocation of portions of tracks 4106 and 4107 and construction of track 4101 would be closely coordinated with the Port to ensure that no adverse effect on existing Port rail operations would occur. Therefore, impacts from Applicant-proposed rail infrastructure improvements would be negligible.

Vessel Transportation

Barges would be used to transport cranes, pile-driving equipment, and construction materials for in-water work. The barges would likely be towed or pushed into position by tugboats. Barges and other construction-related vessels would mix with marine traffic in the Columbia River, resulting in a temporary traffic increase. This increase may contribute toward congestion along a portion of the river adjacent to the proposed Facility site. However, the volume of additional traffic is expected to be relatively minor, and the temporary increase in vessel traffic would be confined to the in-water construction window of September 1 to January 15. Also, barges used for cranes, pile-driving equipment, and construction materials would likely remain in the construction area for the duration of construction, and would remain outside of the navigational channel. As a result, the movement of barges would not result in a recurring increase in vessel traffic in the Columbia River. Given these considerations, the impact of construction vessels on marine traffic is expected to be negligible.

Operation and Maintenance

Surface Transportation

The Facility would have approximately 176 permanent, full-time staff. Table 3.14-11 presents the traffic generation associated with this workforce. As shown, this staff would generate 532 daily trips, including 77 in the morning peak hour and 74 in the afternoon peak hour.

Table 3.14-11. Operation and Maintenance Traffic Generation

Land Use Classification	Number	Daily Trips	Weekday AM Peak Hour			Weekday PM Peak Hour		
			Total	In	Out	Total	In	Out
Light Industrial	176 Employees	532	77	64	13	74	16	58

Source: Kittelson & Associates, Inc. 2014

The results of intersection capacity analysis under year 2020 conditions is shown in Table 3.14-12. As illustrated in this table, operation and maintenance staff traffic would not result in any change in LOS, or cause the applicable performance standard (i.e., LOS or v/c) to be exceeded. Therefore, impacts to roadways from operation and maintenance traffic are expected to be minor.

Table 3.14-12. Intersection Peak Hour Levels of Service, with Operation and Maintenance Traffic

Location	Control	Peak Hour	2020		2020 Plus Operation and Maintenance		Standard	Exceeds Standard?
			LOS	V/C	LOS	V/C		
Old Lower River Rd/ SR 501	Signal	AM	B	0.08	B	0.11	LOS D	No
		PM	A	0.08	A	0.15		No
NW Gateway Ave/SR 501	Stop Sign	AM	A	0.08	A	0.08	LOS D	No
		PM	A	0.07	A	0.07		No
Fourth Plain Blvd/SR 501	Stop Sign	AM	B	0.68	B	0.72	LOS D	No
		PM	B	0.34	B	0.37		No
Old Lower River Rd/Old Alcoa Facility Access Rd	Stop Sign	AM	B	NA	B	NA	LOS E & V/C ≤ 0.95	No
		PM	A	NA	A	NA		No

Source: Kittelson & Associates, Inc. 2014

LOS = level of service, v/v = volume/capacity ratio

Rail Transportation

The Facility would accommodate four trains per day. Each train would include 100 to 118 tank cars, two buffer cars, and three locomotives. Two unit train unloading facilities would be constructed in the initial 12-month Project development phase, with a third unloading facility added in the subsequent 6 months to achieve full buildout. Each 7,800-foot-long train would require approximately 12 to 14 hours to unload. Therefore, up to four trains could be unloaded each day during the initial development phase. However, should unloading take more than 12 hours per train before the third unloading facility is completed, it may be necessary to store trains temporarily within the Facility until unloading is complete. Two approximately 7,700-foot-long rail loops are provided to accommodate unit trains. As shown on Figure 2-5, the proposed long railcar unloading facility can accommodate three parallel lines of railcars along a length of 1,850 feet. Also, the spur rail line extending from the proposed Facility is 2.3 miles long and includes a number of sidings and/or switching tracks. Given the anticipated rate of unloading and the availability of storage within and adjacent to the proposed Facility site, queues that extend into the mainline are not anticipated. Therefore, the proposed Project's impact to rail transportation would be negligible.

Vessel Transportation

Crude oil would be transferred from the proposed Facility to tanker vessels at marine terminal Berth 13.[9] Berth 13 would accommodate one tanker vessel for loading at a time, and each vessel would be at dock for approximately 24 hours. Therefore, on an annual basis, the marine terminal would accommodate 365 tanker vessels. Each approaching tanker vessel would be supported by two docking assist tugs, which would maneuver the tanker vessel into dock. The docking assist tugs would be released once the tanker vessel is secured at dock and would not stand by Berth 13 during loading operations. Following loading, two docking assist tugs would pull the tanker vessel away from the dock and position it so that it is facing downriver. Once the tanker vessel begins to make headway, the tugs would be released and the tanker vessel would proceed westward along the Columbia River navigation channel. The movement of tanker vessels and, to a lesser extent, docking assist tugs, would contribute toward marine traffic near the proposed Facility. The maneuvering of outbound tanker vessels from Berth 13 to face westward may cause a delay for other vessel traffic passing the terminal. Nevertheless, the docking of tanker vessels at Berth 13 would be consistent with the types of vessels that have historically docked at this berth (BergerABAM 2014). Therefore, the use of Berth 13 is expected to result in minor impacts to vessel traffic in the vicinity of the marine terminal facility.

Decommissioning

Surface Transportation

The number of workers and truck deliveries for decommissioning is expected to be less than for construction because the scope of decommissioning activities would be less than that of construction. As discussed above, construction-related traffic impacts would be relatively minor. Therefore, because decommissioning is expected to involve fewer worker and truck trips, the impact would also be minor.

Rail Transportation

Facility decommissioning is not anticipated to include removal of the Facility-related loop tracks. Therefore, no potential disruption of existing rail operations within the Facility site would occur, and decommissioning would have no impact to rail transportation.

9 Berth 14 would be used to store equipment and perform operations associated with spill prevention and response; no crude oil would be transferred to vessels at this berth.

Vessel Transportation

The modifications to the marine terminal berths are anticipated to be retained and no other modifications to the marine terminal are proposed during decommissioning. Therefore, decommissioning activities are not expected to have any impact to marine transportation.

3.14.3.2 Rail Transportation

Rail System Capacity

Approximately four trains per day on average would deliver crude oil to the proposed Facility, ranging from 100 to 120 sole purpose crude oil tank cars per train and having an anticipated typical unit train length of approximately 7,800 feet. It is assumed for this analysis that inbound fully loaded trains would use the Columbia River Alignment, while the empty trains would most likely use the Central Return-Stampede Pass Alignment. Given the assumptions noted, Table 3.14-13 shows the potential increase in daily train volume over existing conditions on the Columbia River and Central Return-Stampede Pass Alignments, as well as the impact these additional trips would have on the utilization rates of the railway segments. BNSF would dispatch full and empty trains as needed to maintain schedules and capacity and in consideration of existing conditions on each route. Travel routes and patterns, especially for the return of empty trains, would likely vary by day and by season.

Table 3.14-13 shows that the rail traffic associated with the proposed Facility would increase the overall utilization on all of the rail segments. As a result, demand would exceed capacity on the south of Spokane to Pasco segment. The Pasco to Vancouver and Spokane segments, also along the Columbia River Alignment, would have utilizations of 80 percent or more and would, therefore, be approaching capacity. The addition of trains associated with the proposed Facility would increase utilization along the south of Spokane to Pasco rail line segment by 22 percent, which would exceed the capacity of this segment. This addition could lead to increased congestion along the rail corridor and could result in additional delays and/or queues. Such rail congestion could impact other users of the rail system, such as grain farmers, resulting in delays in moving their goods to market.

Decisions on the use of locomotives and railroad lines are based on commercial market factors. For example, at some times of year, shipments of anhydrous ammonia[10] (for fertilizer used in spring planting) are given priority (Ecology 2015). Considering that the addition of rail traffic associated with the proposed Facility would cause some segments of rail lines to approach or exceed capacity, that trains may be prioritized with some shipments experiencing delays, and that operational or physical improvements could be made to address additional rail traffic, impacts to rail transportation could be moderate to major.

Outside of Washington, an increase in train traffic may cause some rail segments to approach or exceed capacity, particularly in areas of high freight movements. For these rail segments, similar impacts including rail congestion resulting in delays and/or queues may occur, resulting in moderate to major impacts to rail transportation.

In instances where demand approaches or exceeds capacity, a rail operator would typically implement various operational and/or physical improvements to minimize congestion on the rail network. Operational improvements could include changing train scheduling and/or routing, while physical improvements could include measures to increase capacity (such as additional sidings, segments of double-track). Both types of improvements would be BNSF’s responsibility. To date, no specific BNSF-proposed physical improvements have been identified that would address rail segments likely to be used by unit trains traveling to and from the proposed Facility with existing or anticipated high utilization.

10 A colorless gas or liquid commonly used to make fertilizers.

This Draft EIS does not include analysis of operational or physical improvements that BNSF may make to address conditions on rail alignments with existing or anticipated high utilization. Physical improvements to the BNSF track network would also likely be subject to separate environmental review under the National Environmental Policy Act (NEPA).

Table 3.14-13. Existing and Potential Increase in Daily Train Volume and Utilization of Rail Segments with Implementation of the Proposed Action

Rail Segment	Existing Daily Train Volume[a]	Daily Train Volume with Proposed Facility	Daily Track Capacity	Existing Utilization[b]	Utilization with Proposed Facility	Utilization Increase	Rail Alignment
Columbia River Alignment (freight-only trains in parentheses for all alignments)							
Sandpoint, ID, to east of Spokane, WA	48 (46)	56 (54)	74	65%	76%	11%	Columbia River + Central Return
Spokane, WA	56 (54)	64 (62)	76	74%	84%	12%	Columbia River + Central Return
South of Spokane, WA, to Pasco, WA	32 (30)	40 (38)	37	86%	108%	22%	Columbia River + Central Return
Pasco, WA, to Vancouver, WA	28 (26)	32 (30)	40	70%	80%	10%	Columbia River
Central Return-Stampede Pass Alignment							
Vancouver, WA, to Kalama/Longview, WA	41 (31)	45 (35)	78	53%	58%	5%	Central Return
Kalama/Longview, WA, to Tacoma, WA	41 (31)	45 (35)	78	53%	58%	5%	Central Return
Tacoma, WA, to Auburn, WA	41 (13)	45 (17)	115	36%	39%	3%	Central Return
Auburn, WA, to Pasco, WA, via Stampede Pass	6 (6)	10 (10)	39	15%	26%	11%	Central Return

Sources: BergerABAM 2014, WSDOT 2014b

a The number of freight and passenger trains traveling in both directions by segment. For example, on the segment from Sandpoint, ID, to east of Spokane, WA, the daily train volume of 48 represents a combination of trains traveling in both directions on the track segment.

b The ratio of the daily train volume to daily track capacity

At-Grade Crossing Delays

The Proposed Action would result in incremental increases in vehicular delays at roadway-railroad at-grade crossings. The amount of additional delay depends on the length and speed of the train (Ecology 2015) and the volume of affected vehicular traffic. Assuming that the trains associated with the Proposed Action would be 7,800 feet long and traveling at an average speed of 20 mph, the average gate downtime per at-grade crossing would be approximately 5 minutes per train.[11] Therefore, the addition of four trains per day would result in an average increase in gate downtime of approximately 21 minutes per crossing per day, while eight[12] trains per day would result in an increase of approximately 41 minutes per crossing per day. Table 3.14-14 presents the incremental additional delay per crossing per day caused by trains associated with the proposed Facility along the Columbia River Alignment. As shown, gate downtime would be increased by between 15 and 26 percent along the Columbia River Alignment.

Table 3.14-14. Project-Related Gate Downtime along the Columbia River Alignment, by Segment

Segment	Gate Downtime per Day	
	Minutes	Incremental Increase (Compared to Existing Conditions)
Between Idaho and Spokane	41	17%
Between Spokane and Pasco	41	26%
Between Pasco and Wishram	21	15%
Between Wishram and Vancouver	21	15%

Source: BergerABAM 2014

In most cases, the delay experienced by an individual motorist at an at-grade crossing would be higher than the estimated gate downtime shown in Table 3.14-14. This higher delay would be due to the driver decelerating on approach to the closed (or closing) gate, waiting for vehicles in the queue ahead to begin moving after the gate is raised, and then accelerating to the desired speed while passing through the crossing. This additional delay, which is analogous to intersection control delay in the *Highway Capacity Manual* (TRB 2000), would depend on the number of traffic lanes and the volume of traffic. The volume of traffic, in turn, depends both on the context of the crossing (e.g., rural, urban, etc.), day of week (weekday or weekend), time of day (i.e., weekday peak commuting period or off-peak period), and other considerations.

The gate downtime delay, plus the additional delay in decelerating, queueing, and accelerating, would be experienced by *all* motorists present when the train is passing through and, therefore, the magnitude of impact would be the average delay per vehicle multiplied by the number of vehicles that experience the delay. Of 186 at-grade crossings in Washington included in the National Highway-Rail Grade Crossing Inventory database (FRA 2015), 114 included an AADT volume estimate. Among these crossings, the AADT volumes ranged from nearly 13,000 to less than 50. Assuming a uniform distribution of crossing traffic throughout a given day, approximately 138 vehicles would be present when a single train passes through at-grade crossings between Vancouver and Pasco, while approximately 205 would be present for each train crossing between Pasco and the Washington stateline. The average delay for an individual vehicle for a single train would be approximately 2:30.[13] When accounting for the number of affected

11 Based on 4:26 train crossing time (i.e., 7,800-foot-long train travelling at 20 mph, or 1,760 feet per minute) plus 0:30 to lower the gate plus 0:12 to raise the gate = 5:08.

12 The analysis assumes that four loaded trains would travel each day from Sandpoint, Idaho, to Terminal 5 along the Columbia River Alignment, and that the four unloaded trains would return to Sandpoint via the Central Return Stampede Pass Alignment. Therefore, four inbound trains per day would travel on the rail segment between Pasco and Vancouver, and four inbound plus four outbound trips would occur on the segment from Pasco to Sandpoint.

13 For an individual motorist who is approaching the crossing when the gate begins to come down, 1 train would result in a gate downtime delay of just over 5 minutes. However, because drivers would arrive at different times during the gate closure and reopening process, the average gate downtime delay for each driver is estimated to be 2:30 (Analysis Group, Inc. 2014).

vehicles and the number of trains on these two segments (i.e., four trains on the Vancouver to Pasco segment and eight trains on the Pasco to Washington stateline segment), the total combined vehicular delay would be 90 hours each day.[14] In practice, the number of affected vehicles may be lower or higher, since traffic is not typically distributed uniformly throughout the day (TRB 2000).

If a train passes through an at-grade crossing during late night or early morning hours, then it is possible that no vehicles would be affected. However, if a train passes through an at-grade crossing in an urban or suburban context during the peak commuting hours, then more vehicles would be affected than would be the case assuming a uniform distribution. Figure 3.14-7 shows the location of at-grade crossings having an AADT of 2,500 or more. Trains passing through these crossings are likely to affect more traffic than other crossings along the Columbia River Alignment, particularly if the crossings coincide with peak commuting periods. Table 3.14-15 illustrates delays and queues that could occur at each of these locations if a single train were to pass through during peak commuting hours. Because only daily traffic volumes are available, this table is based on generic assumptions about the concentration of daily traffic during the peak hour (assumed to be 10 percent) and the distribution of traffic within the peak hour (assumed to be uniform). As discussed above, the average delay for each vehicle would be 2:30, or 2.5 minutes. As in the table, where a comparatively large number of vehicles would be affected by gate closure, the queues and delays could be substantial. For example, at the 32nd Street crossing in Washougal, the combined total delay would be more than 4 hours and the queue would exceed 2,600 feet.

The incremental additional delay caused by gate downtime would be experienced at 200 roadway-railroad at-grade crossings along the 445-mile Columbia River Alignment. While the number of vehicles that would be affected based on a uniform traffic distribution would be relatively small, a much higher volume of traffic could be affected when trains pass through at-grade crossings in more urbanized areas during peak commuting periods. Given this consideration, and accounting for the fact that rail transportation would increase gate downtime delay by between 15 and 26 percent, impacts to motorists from delays at at-grade crossings resulting from rail transportation associated with the proposed Facility could be moderate to major.

Outside of Washington, the average delay for an individual vehicle to wait at an at-grade crossing for a single train to pass would also be approximately 2:30. The magnitude of impact to motorists as a whole outside of Washington has not been quantified and would depend on the number of vehicles present when a train passes.

14 That is: (138 vehicles x 2:30 per vehicle x 4 trains from Vancouver to Pasco = 1,380 minutes, or 23 hours) + (205 vehicles x 2:30 per vehicle x 8 trains from Pasco to Washington stateline = 4,100 minutes, or 68 hours).

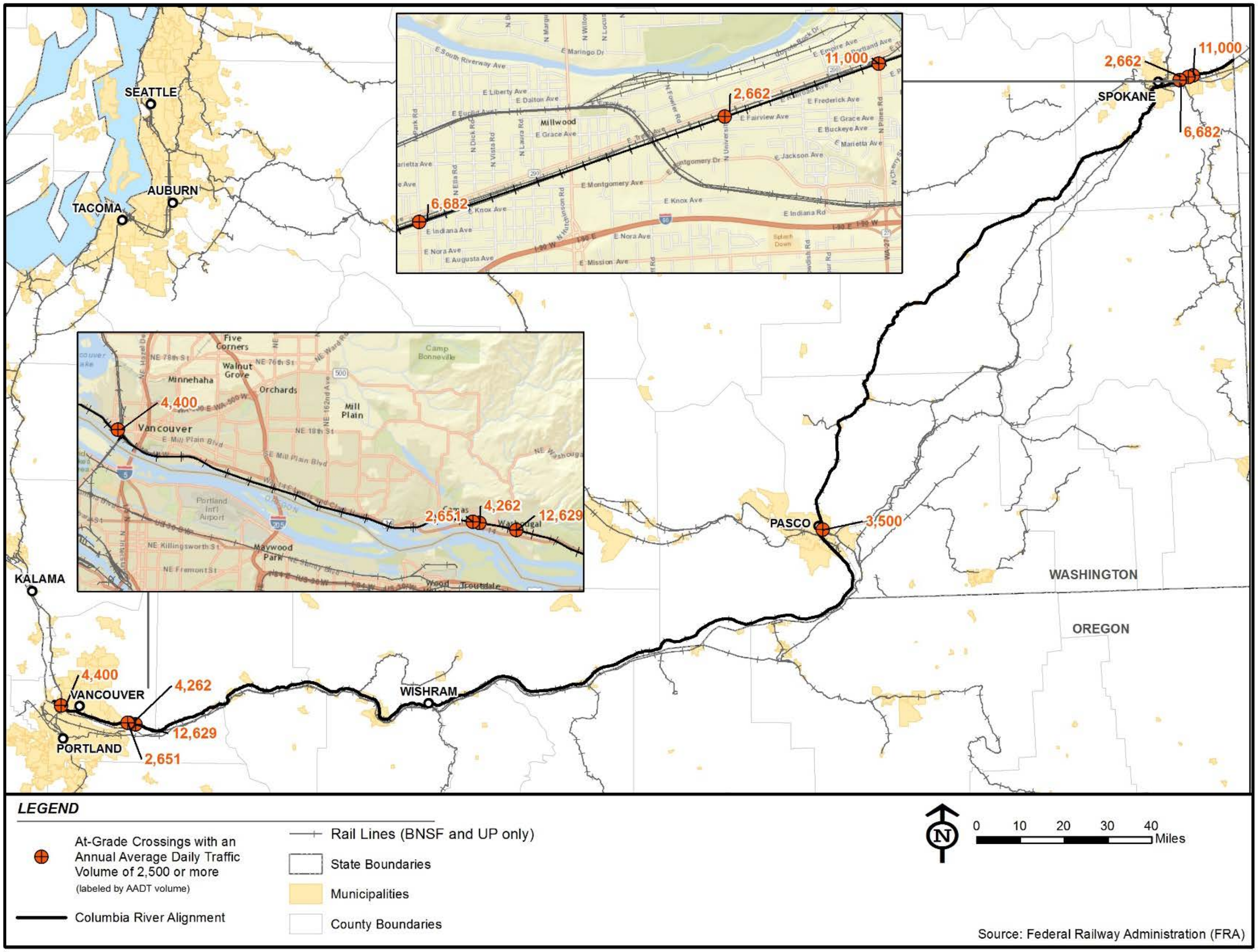

Figure 3.14-7. At-Grade Rail Crossings with Annual Average Daily Traffic Volumes of 2,500 or More

Table 3.14-15. Estimated Total Delay and Maximum Queue Length at At-Grade Crossings with Greater than 2,500 AADT

Crossing Location (street, city)	Existing AADT	Estimated Peak Hour Volume	Estimated Vehicles Affected by One Train[a]	Average Delay Per Vehicle (min)	Total Delay, All Vehicles	Maximum Queue Length[b] (feet)
Pines Rd-SR 27, Spokane Valley	11,000	1,100	92	2.5	3 hr 49 min	2,292
University Rd, Spokane Valley	2,662	266	22	2.5	55 min	555
Park Road, Spokane Valley	6,682	668	56	2.5	2 hr 20 min	1,400
W "A" St at South 1st Avenue, Pasco	3,500	350	29	2.5	1 hr 13 min	725
32nd St/Russell, Washougal	12,629	1,262	105	2.5	4 hr 23 min	2,625
6th St, Washougal	4,262	426	36	2.5	1 hr 30 min	900
3rd St, Washougal	2,651	265	22	2.5	55 min	550
Ind. St W 16th St, Vancouver	4,400	440	37	2.5	1 hr 32 min	925

Notes:

a Assumes uniform distribution of traffic during the peak hour

b Includes traffic on all approaches to the crossing

Crossing locations identified on Figure 3.14-7

Estimated Peak Hour Volume = 10% of AADT

Estimated Vehicles Affected by One Train = Estimated Peak Hour Volume × 1/12

Total Delay, All Vehicles = Estimated Vehicles Affected by One Train × 2:30 per vehicle

Maximum Queue Length = Estimated Vehicles Affected by One Train × 25 feet per vehicle

AADT = annual average daily traffic, SR = State Route

WSDOT-Identified Operationally Sensitive Railroad Crossing Locations

WSDOT has compiled an inventory of existing state highway locations that are operationally sensitive to increases in train traffic. This inventory includes locations that are nearing thresholds to effectively operate under current train volumes. Of the 46 operationally sensitive crossing locations, 26 are located along the unit train delivery and return routes, as shown in Table 3.14-16 and Figure 3.14-8.

WSDOT has indicated that increases in train traffic at these crossing locations would eventually require some degree of mitigation to address impacts related to safety, traffic circulation, vehicle delay, or emergency response capability. Operational improvements could involve fleeting (sending all trains in one direction on certain segments) and adjusting scheduling/timing, speed, and size of trains on particular segments. Physical mitigation measures could include upgrading passive crossings to active safety crossings, rerouting high-traffic routes to use existing grade-separated crossings, adding U-turns to allow drivers to easily access alternate routes, and/or installing grade-separated crossings (bridge or underpass).

Table 3.14-16. WSDOT-Identified Operationally Sensitive Railroad Crossing Locations

DOT Number	County	Road Name	Rail Alignment	Expected Utilization Increase*
090031U	Benton	E 3rd Ave	Columbia River Alignment	10%
090036D	Benton	Perkins Rd 7572	Columbia River Alignment	10%
090169V	Klickitat	Maple St	Columbia River Alignment	10%
092481X	Lewis	SR 506-7th St	Central Return-Stampede Pass Alignment	5%
092484T	Lewis	Walnut St - SR505/603	Central Return-Stampede Pass Alignment	5%
092512U	Lewis	E Locust St	Central Return-Stampede Pass Alignment	5%
092514H	Lewis	Main St	Central Return-Stampede Pass Alignment	5%
092515P	Lewis	Maple St	Central Return-Stampede Pass Alignment	5%
085784P	Thurston	184th Ave SE	Central Return-Stampede Pass Alignment	5%
085786D	Thurston	E 6th St	Central Return-Stampede Pass Alignment	5%
085789Y	Thurston	Connor RD SE	Central Return-Stampede Pass Alignment	5%
104523U	Yakima	Indian Church Rd	Central Return-Stampede Pass Alignment	11%
104536V	Yakima	N. Gulden Rd	Central Return-Stampede Pass Alignment	11%
104534G	Yakima	SR 241 Boundary Rd	Central Return-Stampede Pass Alignment	11%
099178A	Yakima	Jones Rd	Central Return-Stampede Pass Alignment	11%
066236B	Spokane	Idaho Rd	Both Alignments	11%
066239W	Spokane	McKinzie Rd	Both Alignments	11%
066240R	Spokane	Harvard Rd	Both Alignments	11%
066244T	Spokane	Barkar Rd	Both Alignments	11%
066245A	Spokane	Flora Rd	Both Alignments	11%
066367E	Spokane	SR-27 Pines Rd	Both Alignments	11%
066371U	Spokane	University Ave	Both Alignments	11%
066377K	Spokane	Park Rd	Both Alignments	11%
066315M	Spokane	Pine St/Anderson Rd	Both Alignments	22%
065970L	Spokane	F Street/Cheney Spangle Rd	Both Alignments	22%
065971T	Spokane	Cheney Plaza Rd	Both Alignments	22%

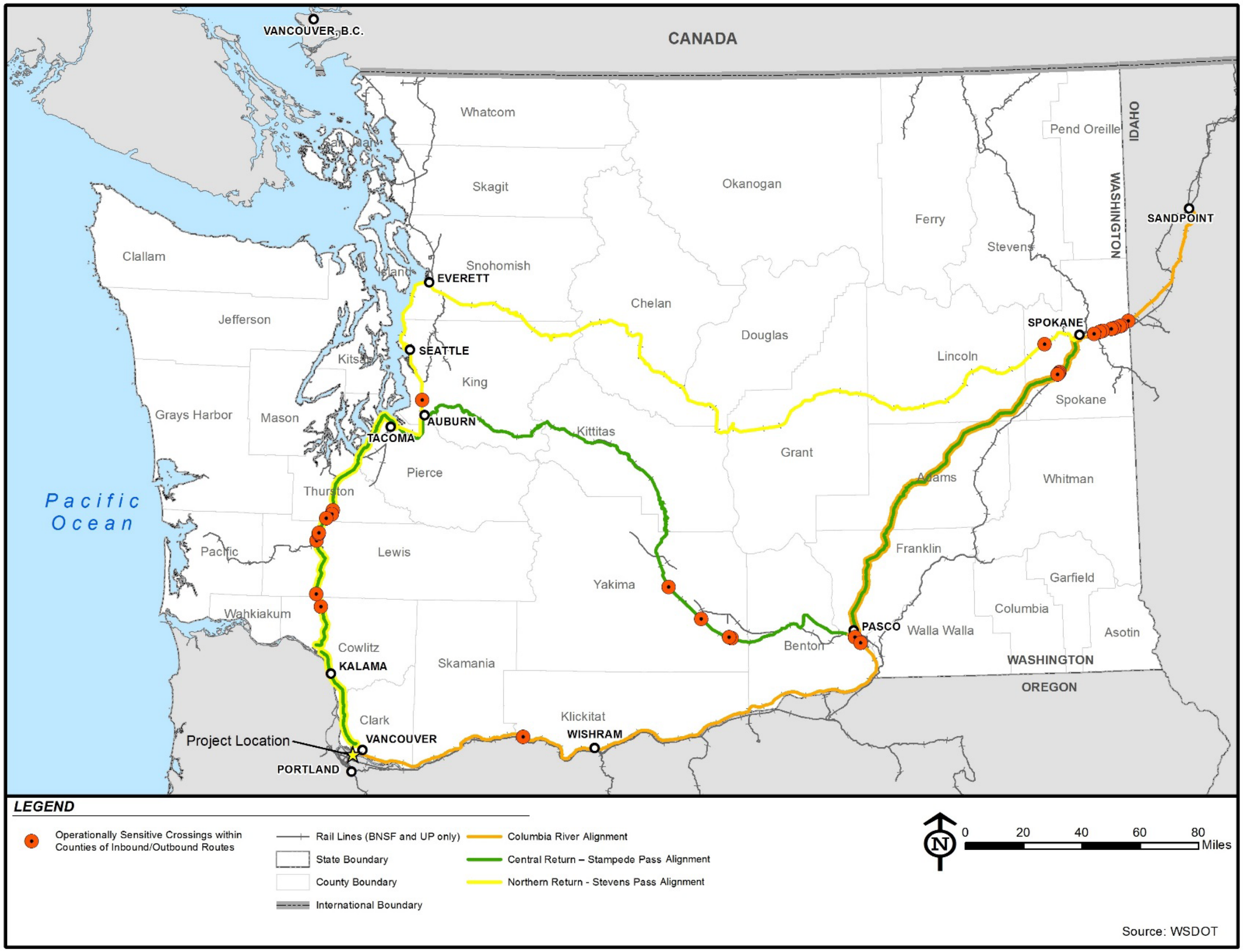

Figure 3.14-9. WSDOT Operationally Sensitive Crossing Locations along the Rail Alignments

Track Use and Maintenance

The new standards for the design and construction of rail tank cars to reduce vulnerability to breaching or failure during derailment (DOT Specification 117) issued jointly by PHMSA and FRA on May 1, 2015 include requirements for increased thickness of the of the tank shell, the addition of full height protection (head shields) at each end, improved protection for the top fittings and discharge valves, and reconfigured tank vents for automatic reclosing (see Section 4.2.4.2 for further information). These new designs and retrofits will increase the weight of rail tank cars which could lead to more track wear and subsequent maintenance (PHMSA 2015). As discussed in Section 3.14.2.2, BNSF has implemented various safety programs and systems involving inspection, detection, and monitoring including the identification of rail defects present in rail gauge, switches, ties, rail, and grade crossings using methods such as ultrasound, eddy current inspection, magnetic particle inspection, radiography, magnetic induction or magnetic flux leakage, and electromagnetic acoustic transducers. Inspections, maintenance, and repair of defects found along the tracks would likely be carried out more frequently with the addition of heavier trains associated with the proposed Facility.

3.14.3.3 Vessel Transportation

Vessels associated with the proposed Facility would increase the number of vessels using the Columbia River navigation channel from the baseline of 1,457 vessel transits[15] in 2013 (Ecology 2014) to approximately 1,822 vessel transits. This amount is below the peak historical number of 2,269 vessel transits. The total of 1,822 annual vessel transits represents approximately half of the capacity of the navigation system.

Increased vessel traffic could result in increased demand for pilot resources. Currently, 45 river pilots and 13 full-time bar pilots belong to their respective organizations. The majority of vessel transits to the Lower Columbia River and Bar do not arrive on a fixed linear schedule and the volume fluctuates from one day to the next. Daily vessel transits that are handled by the pilots can vary from zero to tens of vessel transits, and pilots indicate that the number of available pilots and current vessel management systems are sufficient to handle the anticipated growth (WorleyParsons 2014).

Similarly, increased vessel traffic could result in increased demand for tug assist services (see Sections 2.4.1.5 and 2.7 for discussions of tug assist services). Tug docking services would be provided by Shaver Transportation Company (Shaver) or another tug operator under contract. Shaver maintains a fleet of 13 tugs, 6 of which are presently able to handle the tug assist requirements for the future tankers calling at the proposed Facility. Shaver indicated that the projected traffic increase could be absorbed into the fleet it currently maintains and is currently adding an additional tug (WorleyParsons 2014).

New vessel traffic on the Columbia River associated with the proposed Facility represents an increase from commercial vessel traffic levels of recent years. However, because the projected future volume of vessel traffic is substantially below the capacity of the navigation system, the impact is considered to be minor.

Outside of Washington, beyond the 3-nmi state boundary into the Pacific Ocean, no pilot or tug services would be required and no capacity limitation exists within open ocean. Designated offshore shipping routes exist, although tank ships laden with crude oil typically operate at least 50 nmi offshore (NOAA 2014). As such, no impacts to vessel traffic are anticipated beyond the 3-nmi state boundary.

15 Ecology (2014) counts only entering transits for vessels; thus a “transit” can be considered to be one entry and one exit per vessel.

3.14.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to transportation from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to traffic and transportation beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Transportation and traffic impacts from construction and operation of such a facility are likely to be similar to the proposed Facility. Construction and operation of an industrial facility at Terminal 5 would result in a temporary increase in traffic on the surrounding street system during construction activities, and a permanent increase in traffic caused by worker commuting trips. Also, the operation of an industrial facility would involve an increase in rail and vessel traffic for the transportation of commodities. However, the type and magnitude of these impacts would ultimately depend on the size, type, and capacity of facility developed at the site.

3.14.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations, maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to transportation in this Draft EIS. EFSEC has not identified mitigation measures specifically for the Applicant, but has identified the following studies as additional mitigation measures to reduce impacts to transportation that would require coordination with others:

- BNSF, UTC, WSDOT, and affected local jurisdictions should coordinate to identify the need for, and feasibility of, constructing new grade-separated railroad crossings in areas along the proposed rail routes where excessive gate downtimes and vehicular delays are anticipated.
- UTC, WSDOT, and affected local jurisdictions should coordinate to evaluate railroad crossing locations that are considered by WSDOT to be operationally sensitive to increases in train traffic, to identify appropriate mitigation measures, possibly including upgrading passive crossings to active safety crossings, rerouting high-traffic routes to use existing grade-separated crossings, adding U-turns to allow drivers to easily access alternate routes, and/or installing grade-separated crossings (bridge or underpass).

Both of these studies should be modeled after and coordinated with the study to be undertaken by the Washington State Legislature's Joint Transportation Committee (JTC) to investigate road-rail conflicts in Washington cities. The goal of the JTC study is to recommend a corridor-based process to prioritize projects addressing the impacts of increased rail traffic. The study is scheduled to be completed by December 1, 2016 (JTC 2015).

3.14.6 Significant Unavoidable Adverse Impacts

Rail transportation associated with the proposed Facility would result in incremental additional delay caused by gate downtime at 200 roadway-railroad at-grade crossings along the 445-mile Columbia River Alignment. The total duration of gate downtime delay caused by a single train at each crossing, including the time needed to raise and lower the gate, is just over 5 minutes. When accounting for all of the proposed trains, the combined gate downtime delay at each at-grade crossing would be between 21 and 41 minutes per vehicle each day if a single vehicle encountered all trains in the same day. This amount represents an increase of between 15 and 26 percent, as compared to existing gate downtime delay at-grade rail crossings caused by existing rail traffic.

An increase in train traffic may cause some rail segments to approach or exceed capacity, particularly in areas of high freight movements. For these rail segments, similar impacts including rail congestion resulting in delays and/or queues may occur, resulting in moderate to major impacts to rail transportation. However, in the event that mitigation measures to address rail congestion as discussed in Section 3.14.5 above are implemented and are effective, this level of impact could be reduced to minor or negligible levels.

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3.15 PUBLIC SERVICES AND UTILITIES

This section addresses how construction, operation and maintenance, and decommissioning of the proposed Facility may affect the demand and availability of public services and utilities, including fire protection and emergency medical response, police and security services, hospital services, water supply, wastewater, solid waste, and cable communications. The effects on public services and utilities from transportation of crude oil to and from the Facility via train and vessel are also addressed.

3.15.1 Methods of Analysis

The study area for assessing impacts of the proposed Facility on public services and utilities varies by individual public service or utility. The proposed Facility study area encompasses the following:

- The geographic limits of the Vancouver Police Department's (VPD's) jurisdiction for police services and the geographic limits of the Port's security services coverage
- The geographic limits of the Vancouver Fire Department's (VFD's) jurisdiction for fire protection and emergency medical response services
- The major hospitals in Portland and Vancouver

The study area to assess the use and availability of a utility service consists of the service territory for each utility; the study area used to assess effects to utility infrastructure was limited to the area of construction activity and operating footprint for the proposed Facility.

The rail corridor study area consists of the geographic limits served by police departments, fire protection, and emergency medical response. Fire protection districts are shown on Figure 3.15-1.

Likewise, the vessel corridor study area includes the service areas for police services, fire protection, and emergency medical response.

Since rail and vessel transportation would not affect nonemergency medical services, wastewater, water supply, solid waste, and communication utilities, impacts to these services and utilities were not included in the analysis.

3.15.1.1 Analytic Approach

The Applicant conducted an initial assessment of impacts to public services and utilities using information from websites, emergency response plans, emergency preparedness information, and land management plans published by the City of Vancouver, Clark County, the Port of Vancouver, VPD, VFD, North Dakota Department of Emergency Services, Montana Department of Environmental Quality, USCG, BNSF Railway, and Clark County Local Emergency Planning Committee. EFSEC reviewed and validated the results of the Applicant's initial analysis and supplemented the analysis with information obtained through meetings and correspondence with the VFD and other emergency service and utility providers.

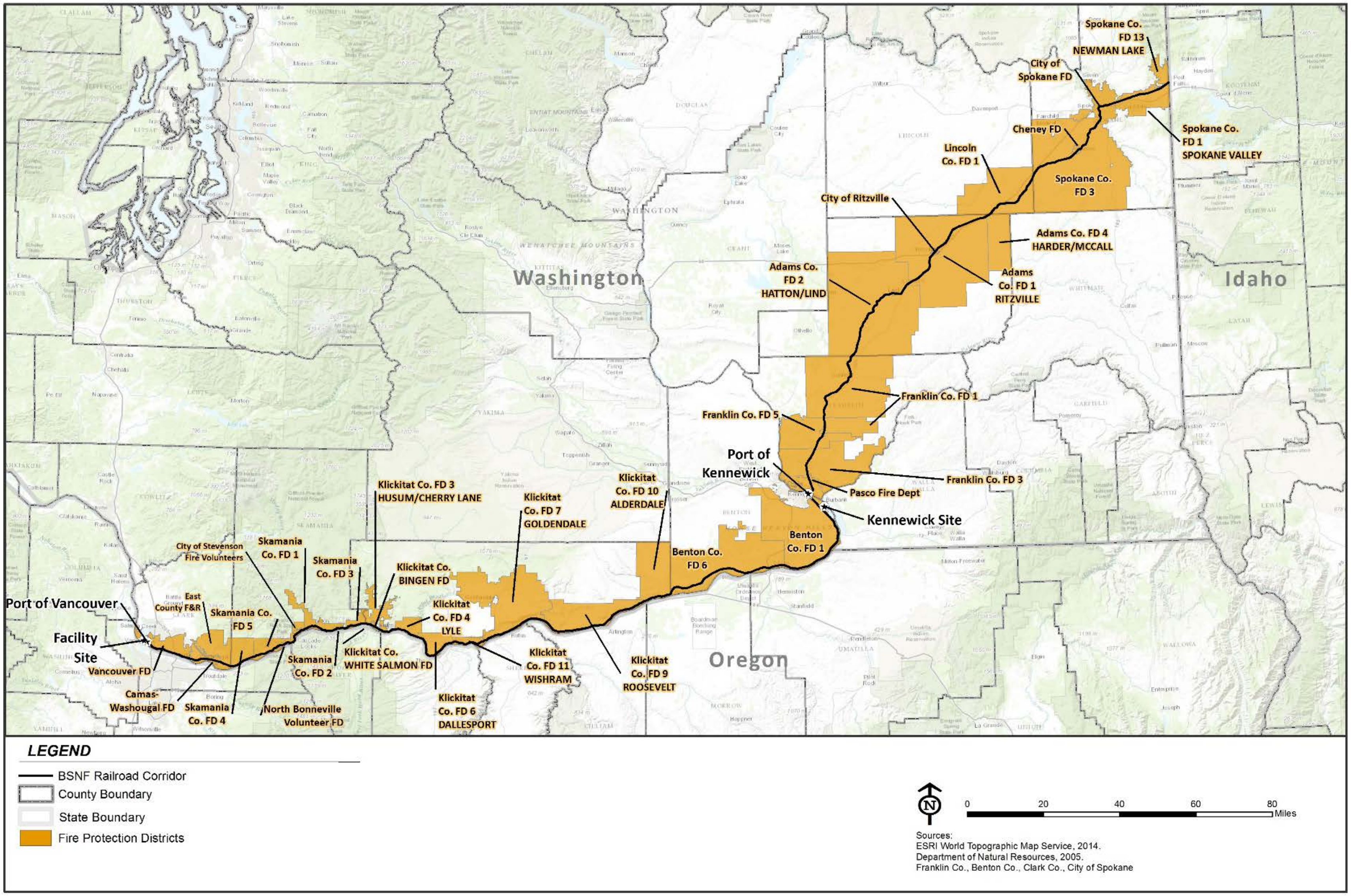

Figure 3.15-1 Fire Protection Districts within the Rail Corridor Study Area

Note: An enlarged version of this figure is available in Appendix P.11.

The analysis of impacts to the availability of public services and utilities was conducted by comparing existing operational capabilities/resources and current level of demand for service to the anticipated increase in demand for service from proposed Facility construction, operation and maintenance, and decommissioning to determine if the increased demand for service would impact the ability of a service or utility provider to deliver an adequate level of service. The analysis of effects to utility infrastructure was performed by determining the need for infrastructure improvements based on the proximity of existing utility infrastructure at the proposed Facility location.

The analysis of effects to police services, fire protection, and emergency medical response services along the rail corridor considered the potential for emergency response vehicle delays at at-grade crossings from lowered gates due to passing trains. A survey of fire departments and fire protection districts located along the rail corridor (Figure 3.15-1) was conducted. A questionnaire was sent to these jurisdictions to enquire whether rail traffic currently impacts their ability to provide timely fire protection and emergency response and the results are incorporated into this analysis. The potential impacts to emergency responders from a crude oil spill, fire, or explosion are discussed in Section 4.6.4.2.

The analysis of effects to police services, fire protection, and emergency medical response services along the vessel transportation corridor considered the potential for blockage of emergency response vessels and increase in demand for emergency responders from a vessel accident. The potential increase in demand for emergency responders from a vessel oil spill, fire, or explosion is discussed in Section 4.6.4.3.

3.15.2 Affected Environment

3.15.2.1 Proposed Facility

Fire Protection and Emergency Medical Response Services

Vancouver Fire Department

The VFD provides fire protection and emergency medical response services to the Port of Vancouver, including the Port's waterfront facilities and vessels moored to its piers. Clark County Fire District #5 has a service contract with the VFD to provide emergency and prevention services (Clark County 2013a); VFD therefore serves 254,625 people in the combined City and Clark County Fire District 5 service area (Eldred, pers. comm., 2015a).

The VFD consists of 10 fire stations and 200 personnel including suppression staff, administrative staff, and the Fire Marshal Office's staff. A minimum of 40 suppression personnel are on shift at any given time, including 38 firefighters and officers and 2 battalion chiefs. The closest station to the proposed Facility is Station 1, currently located at 900 W Evergreen and approximately 3 miles from access to the proposed Facility site via NW Gateway Avenue (Eldred, pers. comm., 2015a). The City of Vancouver plans to rebuild and relocate Station 1 to a property at 2607 Main Street, located approximately 2.9 miles from NW Gateway Avenue (City of Vancouver 2015a; Eldred, pers. comm., 2015a). A fire engine, fire truck, command unit, and reserve fire engine are based at Station 1. Table 3-15.1 lists the VFD's current fire apparatus across all 10 stations.

During 2014, the VFD responded to 23,195 emergency calls, including 3.6 percent that were directly fire-related and 72 percent that consisted of calls for medical assistance (Eldred, pers. comm., 2015a). For all calls made in 2014, the VFD's actual response time to arrive at the scene from the point of dispatch was faster than the standard for response time at least 90 percent of the time (Table 3.15-2). The closest stations to the proposed Facility, Stations 1 and 2, currently have a response time for Priority 1 and 2 events of 8:36 and 9:25, respectively, from the time of dispatch until arrival at NW Gateway Avenue. In 2014, the VFD met or exceeded the service level requirements adopted by the City of Vancouver, measured in terms of response times (Standard of Cover). Table 3.15-2 compares VFD's actual response times to the Standard of Cover for different call types.

Table 3.15-1. Current Vancouver Fire Department Apparatus

Apparatus	Number
Fire Engine	10
Reserve Fire Engine	3
Water Tender	3
Brush Unit	2
Rescue Unit	1
Heavy Rescue Unit	1
Medical Rehab Unit	1
Mobile Air Compressor	1
Ladder Truck	2
Reserve Ladder Truck	1
Hazardous Materials Unit	1
Command Unit	2
High Volume Pump and Foam Unit	1
Fire Investigation Unit	1
All Hazard Quick Response Vessel	1

Source: Eldred, pers. comm., 2015a

Table 3.15-2. Vancouver Fire Department's Standard of Cover and Actual Response Times by Call Type

Call Type	Standard	Actual
Arrival of First Fire Response Unit		
All Priority 1 and 2 calls except marine	7:59	7:51
All Priority 3 and 4 calls except marine	10:59	8:49
Priority 5 nonmedical calls	15:59	10:37
Priority 5 emergency medical calls – ambulance only	15:59	13:41
Marine – all calls	19:59	11:21
Arrival of Full First Alarm Assignment		
Fire suppression	15:59	14:30
Aircraft rescue and firefighting	15:59	n/a[a]
Technical rescue	60:00	54:32[b]
Hazardous materials	60:00	n/a[c]

Source: Molina 2015

Notes:

a No aircraft rescue and firefighting responses for VFD units in 2014

b Only one "full team" technical rescue response in VFD service area in 2014

c No "full team" hazmat responses in 2014

VFD identified as a goal for 2015-2016 to improve turnout times for Priority 1 and Priority 2 events (except calls to respond to marine events), as the actual response time in 2014 (7 minutes, 51 seconds) was just 8 seconds below the standard for response time for Priority 1 and Priority 2 calls (7 minutes, 59 seconds; Molina 2015).

The Washington Surveying and Rating Bureau rates fire departments based on efficacy of water distribution systems, fire prevention programs, and emergency communications. Class 1 is the best rating, classified as the ideal fire department and Class 10 is the worst with the most deficiency points (West Pierce Fire & Rescue 2014). The VFD maintains a Class 4 rating from the Washington Surveying and Rating Bureau (2014). The VFD has taken steps to improve and streamline the provision of emergency medical response services, including adjusting low-priority (Priority 5) medical calls to an ambulance-only response (instead of also sending a fire truck) to maintain readiness to respond to higher-priority calls (City of Vancouver 2015b).

The City has acquired an all hazard quick response vessel through a Federal Emergency Management Agency Port Security Grant to boost regional marine emergency response capabilities along the Columbia River (City of Vancouver 2015c). The vessel is rated as a National Fire Protection Association Type IV vessel with firefighting capability and is moored at Christensen Shipyards at approximately RM 109, which is approximately 6 miles upriver of Terminal 5. The suppression crew from Station 1 cross-staffs both the vessel and Engine 1; Engine 1 is therefore out of service while the boat is responding and on a call (Eldred, pers. comm., 2015a).

VFD has a limited mutual aid agreement with Portland Fire Department. Under the agreement, VFD can request any type of apparatus as long as use of that apparatus would not impact the level of service provided by Portland Fire Department; however, that agreement specifies that neither party shall provide the other assistance for hazardous materials incidents (Eldred, pers. comm., 2015b). VFD also has mutual aid agreements with all Clark County fire agencies for automatic response within certain areas and by request in other areas. Most of mutual aid companies with Clark County are limited in staffing and rely heavily on volunteer capabilities (Eldred, pers. comm., 2015b). In addition, VFD is a participant in Washington State Homeland Security Region IV, which includes Clark, Cowlitz, Skamania, and Wahkiakum counties. VFD houses most of the specialty equipment for Region IV at its stations and has access to the resources available through Region IV when initial mutual aid agreements are exhausted or when specialized equipment is needed (Eldred, pers. comm., 2015a).

Clark Regional Emergency Services Agency

Clark Regional Emergency Services Agency (CRESA) provides 911 dispatch operations, emergency management, and related technical and administrative services through an interlocal agreement with Clark County, the seven cities within the county, and participating fire districts. CRESA’s consolidated 911 Dispatch Center receives and dispatches all 911 calls for all incorporated and unincorporated areas of Clark County, as well as portions of Cowlitz and Skamania counties (CRESA 2015a). The CRESA Emergency Management Program deals with all aspects of disasters within the community, including preparedness, mitigation, response, and post-disaster recovery (CRESA 2015b). CRESA also provides ambulance contract oversight for emergency medical service. Beginning January 1, 2015, the City of Vancouver began contracting directly for ambulance services with American Medical Response instead of through the interlocal agreement (City of Vancouver 2015d). Clark County Fire District #5, which has a service contract with the VFD to provide emergency and prevention services, receives ambulance service through its contract with the City of Vancouver (Clark County 2013a).

Police and Security Services

Vancouver Police Department

The VPD provides law enforcement at the proposed Facility site. The VPD covers a service area of approximately 49 square miles and provides 24-hour response for public safety and services within the City. Within Clark County outside of the City, law enforcement is carried out by the Clark County Sheriff and other city police departments. The proposed Facility site is located approximately 5.5 miles west of the nearest police station, located at 2800 NE Stapleton Road. The VPD currently employs 187 sworn staff, which includes 17 corporals, 28 sergeants, 7 lieutenants, 4 commanders, 2 assistant chiefs, and 1 chief. Of these, 12 sergeants, 11 corporals, and 74 officers are assigned to patrol. In addition, a Neighborhood Response Team comprised of 2 sergeants and 8 officers assists with patrol. Each of the two precincts (East and West) has two neighborhood police officers assigned to a district who are available to meet with residents of that district to discuss livability issues, crime issues, and crime trends and prevention, and to attend community meetings (Kenning, pers. comm., 2015). The VPD also provides a range of public safety and police services including patrol, an investigations division, and a special operations division (ICMA 2013). In 2012, the VPD had three EMT paramedics and two EMT-IV technicians on staff to provide medical support to the region’s SWAT Team (VPD 2012).

Crime rates in Vancouver fluctuate from year to year but, in general, are decreasing and are similar to comparable Washington communities and state and national averages. Crime in Vancouver, in general, is on par with communities of similar size in the Pacific Northwest (ICMA 2013). During the 12-month period from January 1, 2012, to December 31, 2012, VPD officers were dispatched to 84,860 calls, an average of approximately 233 calls per day.

In 2012, the average response time for highest-priority VPD calls was 8.2 minutes, and overall response times averaged 19.6 minutes across all levels of priority (ICMA 2013). A data review of the VPD’s 2012 operations conducted by the International City/County Management Association (ICMA) found response times to be higher than the benchmark “considered acceptable” of 5.0 minutes for high-priority calls and a 15.0-minute average response time for all calls. The ICMA report also found that while the VPD provides a high level of service to the City with the resources it has, it is understaffed and faces challenges resulting from budget cuts and personnel reductions (ICMA 2013). A Community Task Force Report (City of Vancouver 2013) stated that the VPD would likely need additional funding to maintain service levels given the growth of the community and the parallel increase in demand for police services. The VPD lacks some positions commonly provided by other police departments, such as a property crimes detective and a DUI team because staffing levels have not kept pace with population growth in the service area (City of Vancouver 2013).

Port of Vancouver Security Services

The Port of Vancouver provides security services at the proposed Facility site and all Port operations are conducted in accordance with the Port’s security program. Access to the Port’s marine terminals is allowed primarily through the main security gate at the 26th Avenue overpass. The Port’s Security Plan and policies require that all people entering the Port’s terminal areas show photo identification and have a valid business purpose to access existing tenant operations. This check is accomplished through the Port’s screening process and is administered to anyone who enters the Port’s marine terminals. In addition, Port general access areas are secured with fencing, video camera monitors, and 24/7 stationary and mobile patrols. In accordance with the Maritime Transportation Security Act of 2002 (33 CFR 105), all personnel who perform work (including contractors and consultants) within the Port’s maritime facility are required to have a TWIC to perform their duties without an appropriate credentialed person to provide an escort, or to be escorted by a person who has a TWIC. In the same way, USCG requires crewmembers of vessels calling at the Port to carry and present identification documents, and the Port requires a TWIC escort for crewmembers to leave the vessel and enter the Port. This program was established by Congress and is administered by the Transportation Security Agency and USCG.

Hospital Services

The closest hospital to the proposed Facility site is Peace Health Southwest Washington Medical Center, approximately 7.5 miles east on Mill Plain Boulevard in Vancouver. The Washington State Department of Health (WDOH) designated Southwest Washington Medical Center as a Level II Trauma Center (WDOH 2014). Other major hospitals in the area include two in Portland: the Legacy Emanuel Hospital and Health Center, located approximately 7.5 miles southeast of the proposed Facility; and Oregon Health Sciences University, located approximately 10 miles south-southeast of the proposed Facility. Both hospitals are designated Level I Trauma Centers and are the only Level I centers in Oregon (Legacy Health 2015, Oregon Health and Sciences University 2015).

Water Supply

The Port of Vancouver maintains a "Group A" Non-Transient/Non-Community potable water system, regulated under WAC Chapter 246-290 by the WDOH, Division of Drinking Water. The Port's water supply system consists of three wells located within the eastern portion of the Port property. These wells are approximately 100 feet deep and draw groundwater from the Troutdale aquifer. The Port also has two reservoirs that can hold a combined 200,000 gallons of drinking water. As a precautionary measure, all Port drinking water supplied by the Port wells is treated with chlorine (Port of Vancouver 2012).

The Port of Vancouver's water system provides potable water for industrial tenants, ships, washdown, irrigation, and fire protection. The City provides water for the remainder of Port operations (Port of Vancouver 2013).

The City's water system is a Group A system with WDOH identification number 91200L regulated by WAC 246-290 (City of Vancouver 2007). The City receives its water from the Orchards, Troutdale, and Sandy River Mudstone aquifers. The City's water rights total 108 million gallons per day (MGD). Maximum daily demands in mid-2013 were approximately 55 MGD. The City's current source development efforts allow it to provide a current capacity without storage of 80.6 MGD. Therefore, the present municipal water supply has an additional 25.6 MGD of capacity above its maximum daily demand. Online system storage includes approximately 24.5 million gallons, which equates to roughly 11 hours of maximum day demand. Two additional emergency interties with CPU are also available (Clary, pers. comm., 2013a).

Wastewater

The City operates a wastewater collection system that includes two wastewater treatment facilities, approximately 716 miles of total sewer lines, and 41 pump stations. These pumping stations provide a means of moving wastewater from areas lacking gravity sewer lines to an adjacent area where gravity lines exist. The total size of the collection system expands each year due to growth. As of mid-2011, the City sewer district served an estimated 192,000 residents across 55.8 square miles (City of Vancouver 2013). Wastewater from the Port is conveyed through the City's conveyance system to the Westside Water Reclamation Facility located at 2323 West Mill Plain Boulevard. The Westside Water Reclamation Facility is designed with the capacity of approximately 28.3 MGD. Treated wastewater is discharged via a 60-inch-diameter outfall to the Columbia River (Kennedy/Jenks Consultants 2011).

Solid Waste

The City's Solid Waste Services, which is part of the Vancouver Public Works Department, provides solid waste and recycling service in the proposed Facility study area (City of Vancouver 2015e). Clark County has no active public landfills. The City and County contract with Waste Connections, a private waste hauler, for commercial garbage collection services. Waste Connections uses one of three transfer stations located in Washougal (Washougal Transfer Station), Orchards (Central Transfer & Recycling Station), and NW Lower River Road near Vancouver Lake (West Vancouver Materials Recovery Center). Waste from the Central Transfer & Recycling Station and the West Vancouver Materials Recovery Center is then loaded onto barges at the Port of Vancouver and barged 180 miles up the Columbia River, transferred onto trucks at the Port of Morrow, and taken 12 miles to Finley Buttes Landfill. Waste from the Washougal Transfer Station is transported by truck to Wasco County Landfill (Clark County 2015).

Finley Buttes Landfill occupies a permitted 510-acre site with a projected life of 300 years. As currently permitted by the ODEQ, the estimated available fill capacity at the site is 131,859,000 tons of municipal solid waste. The site currently receives approximately 500,000 tons of municipal solid waste each year, more than half of which is from Clark County. Of the 337 acres that comprise Wasco County Landfill, 213 acres are permitted by the ODEQ for active landfilling. The landfill is expected to reach capacity in approximately 73 years (Clark County 2015).

Three garbage transfer stations offer free drop-off recycling during all business hours and free drop-off of household hazardous wastes 2 days per week. Currently, three private recycling companies in Clark County purchase selected materials at their facilities, and the County has four private wood and yard debris processing companies (Clark County 2013b).

Communication Utilities

Qwest and Verizon provide phone service in the proposed Facility study area. Comcast provides cable television service, and Qwest and Comcast provide internet service (Berger ABAM 2014).

3.15.2.2 Rail Corridor

Public law enforcement, fire protection, and emergency medical response providers along the rail corridor include both urban departments (e.g., those serving Spokane, Richland-Kennewick-Pasco, and Vancouver) and smaller, more rural departments (e.g., those serving Cheney, Sprague, Ritzville, Lind, Wishram, White Salmon, Bingen, Stevenson, Camas, and Washougal as well as the unincorporated areas of Spokane, Lincoln, Adams, Franklin, Benton, Klickitat, Skamania, and Clark counties). Figure 3.15-1 shows the fire districts present in the rail corridor vicinity.

According to information provided by BNSF, the company’s first responders and equipment such as industrial fire-fighting foam trailers, emergency breathing air trailers, chlorine kits, midland kits, and air monitoring assets are prepositioned across their rail network (Kalb 2014). BNSF emergency response teams are located at a few locations along the rail route that would be used to deliver product to the proposed Facility, including Spokane, Pasco, and Vancouver. Law enforcement services are also provided by a railroad police team maintained by BNSF (2015a, b).

Similar to the routes within Washington, the routes outside of Washington that could be utilized to deliver product to the Facility and empty railcars back to the source traverse the jurisdictional areas of both urban public law enforcement, fire protection, and emergency medical response providers (e.g., those serving Williston, North Dakota; Havre, Whitefish, and Libby, Montana; and Bonner’s Ferry and Sandpoint, Idaho) and smaller, more rural departments.

3.15.2.3 Vessel Corridor

The Port of Vancouver is a partner in the MFSA. Membership is composed of 25 ports and private facilities along the Lower Columbia and Willamette rivers. The partnership is tasked with ensuring an adequate, timely, and coordinated response to ship fires along the 110-mile shipping channel, which includes 2 states, 7 counties, 14 cities, 7 port districts, and 12 fire agencies (Region 10 Regional Response Team and the Northwest Area Committee 2015). The VFD, along with other fire departments, has an agreement with the MFSA to provide one engine and three people for shipboard firefighting if the agency can provide these resources without impacting service within its jurisdiction (Eldred, pers. comm., 2015a).

The Lower Columbia River and Columbia River Bar is located in USCG Region 13, Sector Columbia River. This sector's area of responsibility extends from the Salmon and Snake rivers (tributaries to the Columbia River) in Idaho down the Columbia River to coastal Oregon and Washington. The USCG Sector Columbia River provides marine inspection, security at ports, and marine environmental protection and response among other services, and is headquartered in Warrenton, Oregon, with additional facilities on the Columbia River at Cape Disappointment and Kennewick in Washington and in Astoria and Portland in Oregon. Personnel within this sector includes 500 active duty, 105 reserve, 29 civilian, and 890 volunteer auxiliary personnel. Other response assets include two 52-foot heavy weather vessels, seven 47-foot motor lifeboats, three MH-60T Jayhawk helicopters, and eight 25- and 29-foot response boats (USCG 2015).

3.15.3 Impact Assessment

3.15.3.1 Proposed Facility

Construction

Fire Protection and Emergency Medical Response Services

If a worker was injured during construction of the proposed Facility, emergency medical services may be requested from the VFD. Existing emergency medical services in the area would be able to address these incidents without impacting service to other users, resulting in minor impacts to emergency medical response services.

Risk of fires during construction would be similar to other industrial construction projects and may require emergency fire response for small events. However, active fire hydrants are onsite and crude oil would not be stored onsite during construction (Gray, pers. comm., 2015b), which would reduce the need for large response. The VFD would be able to address these incidents without impacting service to other users, resulting in minor impacts to fire protection services.

Police and Security Services

The Port of Vancouver’s security program would minimize the need for services from the VPD by restricting access (including access from marine vessels) to the Facility to only credentialed persons or persons with a credentialed escort and by providing 24/7 stationary and mobile patrols. In addition, the Applicant has proposed to conduct a Facility Security Assessment and prepare an operations Facility Security Plan pursuant to the Maritime Transportation Security Act that would be approved by the Port and USCG. Section 2.4.3 describes the contents of this proposed plan. Facility construction is anticipated to temporarily increase the demand on the Port’s security services to monitor the ingress and egress of construction personnel, but is not anticipated to increase the demand for police protection due to the Port’s established security program and the Applicant’s proposed Facility Security Plan. Therefore, impacts to security services at the Port would be minor and impacts to police services would be negligible.

Hospital Services

Occupational safety risks to workers during construction of the proposed Facility would be similar to typical construction activities for similar size and types of projects and may require hospital services. The three major hospitals within approximately 10 miles of the proposed Facility would provide service for these injuries without impacting service to other users, resulting in negligible impacts to hospital services.

Water Supply

Water used during construction would be purchased from either the City of Vancouver or the Port, both of which have adequate water[1] to supply the estimated average water and peak demands[2] and for hydrostatic testing and flushing of the pipeline and tank facilities.[3] The City currently has water rights for 108 MGD and has developed supply capacity (without storage) of 80.6 MGD and maximum daily demands in mid-2013 were approximately 55 MGD (Clary, pers. comm., 2013a). The typical daily water use during construction of the proposed Facility would increase peak water supply demand by less than 0.04 percent. The City has provided a letter confirming that it has sufficient water rights, storage, and distribution capacity to accommodate the water needs of the proposed Facility (Clary, pers. comm., 2013b, 2015). No impacts to water supply are anticipated from construction of the proposed Facility.

Wastewater

Groundwater pumped out of excavations during construction of the proposed Facility would be stored, tested, and disposed of appropriately. If water quality parameters were met, the water would be disposed of via the City's sanitary sewer system. In the event that water quality parameters are exceeded, the wastewater would be removed by a licensed commercial waste disposal facility for offsite treatment and disposal. As such, no impacts to the onsite Wastewater Treatment Plant (WWTP) or the City's sanitary sewer system would occur.

Solid Waste

Construction of the proposed Facility would result in the generation of solid construction debris, such as scrap metal, cable, wire, wood pallets, plastic packaging materials, and cardboard. These materials would be removed by Waste Connections and disposed of via one of three transfer stations to Finley Buttes Landfill or Wasco County Landfill, which have ample remaining landfill space (300 and 73 years, respectively). As such, no impacts to solid waste services from construction of the proposed Facility would occur.

The Applicant would develop a Construction Waste Management Plan to handle the disposal of solid waste generated by construction of the proposed Facility. The Applicant also proposes to recycle construction waste as feasible to reduce the amount of waste generated during construction.

Communications

Accidental damage to communication utility infrastructure and related service interruptions have the potential to occur during construction of the proposed Facility. If utility infrastructure were damaged during construction, service interruptions would be expected to be short term and localized. The potential for utility infrastructure damage would be reduced by calling 8-1-1 prior to commencing such work to identify existing underground utilities to avoid. Impacts to communication utility infrastructure and service interruptions are anticipated to be minor.

1 The City's present municipal water supply has an additional 25.6 MGD of capacity above its maximum daily demand and the Port's water supply system consists of three wells approximately 100 feet deep and draw groundwater from the Troutdale aquifer and two reservoirs that can hold a combined 200,000 gallons of drinking water.

2 Average water demand during construction is conservatively estimated at 20,000 gpd with a peak demand of approximately 720,000 gpd (0.72 MGD).

3 Approximately 20 million gallons of water would be required for hydrostatic testing and flushing of the pipeline and tank facilities.

Operation and Maintenance

Fire Protection and Emergency Medical Response Services

If a worker was injured during operation of the proposed Facility, emergency medical services may be requested from the VFD. Existing emergency medical services in the area would be able to address these incidents without impacting service to other users, resulting in minor impacts to emergency medical response services. Section 4.7.16.1 discusses the impacts that could occur to fire protection and emergency response services in the event of a crude oil spill, fire, or explosion at the proposed Facility.

Police and Security Services

The Port of Vancouver's security program would minimize the need for services from the VPD by restricting access to the Facility to credentialed persons or persons with a credentialed escort only and by providing 24/7 stationary and mobile patrols. Facility operation could slightly increase the demand on the Port's security services to monitor the ingress and egress of Project personnel, but is not anticipated to increase the demand for police protection due to the Port's established security program. Therefore, impacts to security services would likely be minor and no impacts to police services are anticipated.

Hospital Services

Occupational safety risks to workers during operation of the proposed Facility may require hospital services. The three major hospitals within approximately 10 miles of the proposed Facility would provide service for these injuries without impacting service to other users, resulting in negligible impacts to hospital services.

Water Supply

The City of Vancouver has adequate water to supply the maximum of approximately 90,100 gpd (0.09 MGD) of water for process, domestic, and irrigation use during Facility operation and maintenance. The City currently has water rights for 108 MGD and has developed supply capacity (without storage) of 80.6 MGD and maximum daily demands in mid-2013 were approximately 55 MGD (Clary, pers. comm., 2013a). The water estimated to be used by the proposed Facility during operations and maintenance would increase peak demand by less than 0.2 percent. The City has provided a letter confirming that it has sufficient water rights, storage, and distribution capacity to accommodate the Facility's water needs (Clary, pers. comm., 2013b, 2015). As such, no impacts to water supply are anticipated from operation and maintenance of the proposed Facility.

Wastewater

Wastewater would be generated by the proposed Facility from several operations (see Table 2-6 in Chapter 2). The majority (27,100 gpd) of the maximum daily flow of approximately 32,500 gpd of process wastewater and the majority (6,850 gpd) of the maximum daily flow of approximately 7,600 gpd of domestic wastewater generated during operations would be pretreated and discharged to the City's sanitary sewer. The remainder would be collected, stored onsite, and hauled to an approved disposal location. Onsite pretreatment would be conducted per the requirements of the City's industrial wastewater pretreatment permit. Process wastewater streams requiring pretreatment include blowdown and condensate discharges from the boilers in Area 600. The boiler manufacturer would design and furnish pretreatment processes for these waste streams in accordance with industry practices.

Treatment of wastewater discharged from the proposed Facility to the public sanitary sewer would be done at the City's existing WWTP, the Westside Water Reclamation Facility, which has a capacity of 28.4 MGD. In 2010, water throughput was estimated at 10.4 MGD (City of Vancouver 2011), leaving a remaining 18 MGD available in the system. The total amount of wastewater generated during operations from both domestic and process wastewater combined (33,950 gpd[4]) would constitute a fraction of the remaining capacity of the Westside Water Reclamation Facility. Furthermore, the City of Vancouver confirmed that the WWTP would have the capacity to accept the maximum daily flow from the Facility (Dick, pers. comm., 2015); therefore, negligible impacts to the WWTP and the City's sanitary sewer would occur.

Solid Waste

The following solid waste streams are anticipated to be generated during normal Facility operation:

- Oily and non-oily waste and rags resulting from cleaning during maintenance of Facility components
- Oily sludge recovered from the bottom of storage tanks after cleaning (at 10-year intervals according to API standards)
- Domestic garbage and packing materials such as cardboard, paper, and plastic

Solid waste would be removed by Waste Connections and disposed of at Finley Buttes Landfill or Wasco County Landfill. Given that the landfills have the capacity to continue to accept solid waste far into the future, no impacts to solid waste services from operation and maintenance of the proposed Facility are anticipated.

Communications

It is anticipated that communications infrastructure (phone, cable television, and internet service) at the site of the proposed Facility would likely be adequate to serve the Facility without impacts to other customers.

Decommissioning

Decommissioning impacts would be similar to those described for construction of the proposed Facility, and may include:

- Existing emergency medical services in the area would be able to address worker injuries without impacting service to other users, resulting in minor impacts to emergency medical response services.
- The Port's security program would minimize the need for services from the VPD by restricting access to the Facility to only credentialed persons or persons with a credentialed escort and by providing 24/7 stationary and mobile patrols, resulting in minor impacts to security services at the Port and negligible impacts to police services.
- The three major hospitals within approximately 10 miles of the proposed Facility would provide service for injured workers without impacting service to other users, resulting in negligible impacts to hospital services.
- Daily water use during decommissioning of the proposed Facility would likely be similar to or less than construction, resulting in no impacts to water supply.
- Daily water use during decommissioning of the proposed Facility would likely be less than during operations, resulting in negligible impacts to the WWTP and the City's sanitary sewer.

4 Assumes 27,100 gpd daily flow of process wastewater and 6,850 gpd daily flow of domestic wastewater generated during operations would be pretreated and discharged to the City's sanitary sewer.

- Decommissioning of the proposed Facility would result in the generation of solid waste, which would likely be removed by Waste Connections and disposed of via one of three transfer stations to Finley Buttes Landfill or Wasco County Landfill, with ample remaining landfill space (300 and 73 years, respectively), resulting in no impacts to solid waste services.

Recycling of applicable solid waste created during decommissioning would reduce the amount of waste that would need to be placed in landfill. The Applicant-prepared site restoration plan developed prior to the start of decommissioning would describe measures to restore or preserve the site including recycling plans.

3.15.3.2 Rail Transportation

Impacts to police services, fire protection, and emergency medical response consists of delays in response by emergency vehicles as a result of at-grade crossings blocked by passing trains. The potential increase in demand for emergency responders from a rail accident is discussed in Section 4.7.16.2.

The survey of fire departments and fire protection districts located along the rail corridor to enquire whether rail traffic currently impacts their ability to provide timely fire protection and emergency response provided the following information:

- Eight out of 11 responding jurisdictions (72 percent) responded that rail traffic currently impacts their ability to provide timely fire protection and emergency response.
- One jurisdiction noted that rail traffic sometimes stops traffic flow on the two primary access roads that divide the eastern side of the city from the western side.
- One jurisdiction reported that rail traffic may delay the provision of mutual aid resources.
- The majority of responding jurisdictions (80 percent) reported that they do not have a communications protocol/plan or technological devices (e.g., GPS, video cameras, wireless technology) in place to inform first responders about blocked crossings and the best alternative routes.

Delays at any particular at-grade crossing would depend on the volume, length, and speed of trains using these crossings (see the discussion of at-grade crossing delays in Section 3.14.3.2). These factors in turn depend on the type and weight of trains as well as the characteristics of a particular crossing (track, signals, barriers, and highway approaches, among others). Impacts to the provision of public services would depend partially on time of day and whether an alternative route (such as an above- or below-grade crossing) is nearby. For example, the city of Spokane has no at-grade crossings, so emergency service providers would not experience delays due to train traffic in Spokane. Conversely, in the cities of Bingen, White Salmon, and Vancouver, some at-grade crossings have no alternative routes, so emergency service providers would likely experience delays in responding to emergencies when response coincides with a passing train.

The average gate downtime per at-grade crossing would be approximately 5 minutes per train and the addition of four trains per day would result in an average increase in gate downtime of approximately 21 minutes per crossing per day (see the analysis in Section 3.14.3.2). The incremental additional delay caused by gate downtime could be experienced at 200 roadway-railroad at-grade crossings that occur along the 445-mile Columbia River Alignment (Figure 3.14-4).

Delays to emergency response can result in harm to human health and property. Impacts to individuals and communities along rail corridors from delays in emergency response can result in deterioration in expected outcome for ambulance patients, worsening of fire damage from delayed fire truck response, reduced likelihood for apprehension of suspects from delayed police response, and additional stress for emergency responders and victims (FRA 2006). The additional four unit trains per day associated with the proposed Facility would increase gate downtime by between 15 and 26 percent along the Columbia River Alignment. While emergency service providers currently have the potential to be delayed by existing train traffic, an increase in delays could constitute a major impact to emergency responders.

Impacts to communities along the rail route outside of Washington State could be similar to those inside the state. Communities in areas with no alternative routes to at-grade crossings would experience delays in emergency response in the event that an emergency coincided with the passing of a unit train, which could pose a risk to human health and property.

3.15.3.3 Vessel Transportation

Vessel operations do not typically require the provision of public services unless an incident or accident occurs. Emergency response for oil spills, fires, and explosions is discussed in Section 4.7.16.2.

The one vessel (two trips) per day associated with the proposed Facility would not block the passage of emergency response vessels responding to events within the Columbia River (see Section 3.14) and would not result in the need for additional response (see Section 3.8). As such, vessels associated with the proposed Facility would result in no impacts to public services and utilities.

3.15.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to public services and utilities from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue with no additional impacts to public services and utilities beyond existing conditions.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Construction and operation of such a facility would likely increase demands on utilities by consuming water and producing solid waste and wastewater, although without knowing which facility would be constructed, it is not possible to quantify amounts. Existing solid waste and wastewater utilities at the site would likely be able to accommodate most facilities.

  Another facility constructed and operated at the Port under the No Action Alternative may increase demands on public service providers by requiring emergency medical response and hospital services in the event of a worker injury, the extent to which would depend on the injury rate. It is likely that existing emergency medical services in the area would be able to address worker injuries without impacting service to other users. In addition, demands on the Port's security services would likely increase in a similar way as the proposed Facility, requiring the need to monitor the ingress and egress of personnel at a different facility. In the event that rail lines are used for another facility under the No Action Alternative, additional rail traffic would likely increase the potential for delays for emergency responders at at-grade crossings.

3.15.5 Mitigation Measures

The design features and BMPs the Applicant proposed to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to public services and utilities in this Draft EIS. EFSEC has identified the following additional mitigation measures to reduce impacts to public services and utilities that would require coordination with others:

- Encourage BNSF to make SECURETRAK, (a real-time GIS tracking program for crude-by-rail trains for use by state and/or regional fusion centers,) available to emergency response vehicles in areas with at-grade crossings along the proposed rail route in Washington. BNSF should provide grants to those jurisdictions that would require technology upgrades and training in order to effectively use SECURETRAK.
- Investigate the need for and feasibility of constructing new grade-separated railroad crossings in cities along the proposed rail route to reduce impacts to emergency response times from increased train traffic and excessive gate downtimes. Such studies could be funded in part by BNSF as is currently being done for a mayor-appointed task force conducting a similar investigation in Edmonds, Washington (My Edmonds News 2015). Study participants should include BNSF, UTC, WSDOT, and affected local jurisdictions and emergency responders. See Section 3.14.5 for a discussion of mitigation for at-grade crossings. This study should be modeled after and coordinated with the JTC study to investigate road-rail conflicts in Washington cities scheduled to be completed by December 1, 2016.

3.15.6 Significant Unavoidable Adverse Impacts

Delays to emergency responders (including fire protection, emergency medical service, and police protection) could occur along the rail corridor from trains associated with the proposed Facility in areas with at-grade crossings when a train is passing. Delays to emergency response can result in deterioration in expected outcome for ambulance patients, worsening of fire damage from delayed fire truck response, reduced likelihood for apprehension of suspects from delayed police response, and additional stress for emergency responders and victims (FRA 2006). The additional four unit trains per day associated with the proposed Facility would increase gate downtime by between 15 and 26 percent along the Columbia River Alignment. While emergency service providers currently have the potential to be delayed by existing train traffic, an increase in delays could constitute a major impact to public services.

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3.16 SOCIOECONOMICS

This section describes the population, housing, and employment resources in the proposed Project vicinity. The impacts of construction, operation and maintenance, and decommissioning of the proposed Facility on these resources as well as from rail and vessel operations associated with the proposed Facility are assessed. The potential for minority and low-income populations to be negatively affected by the proposed Facility, termed "environmental justice," is also analyzed. Mitigation measures are provided for moderate to major impacts and significant impacts that remain are identified.

3.16.1 Methods of Analysis

The following study areas were used in the socioeconomics analysis:

- **The proposed Facility study area**. Consists of the counties within a 1-hour drive of the proposed Facility, including Clark, Cowlitz, and Skamania counties in Washington; and Clackamas, Columbia, Hood River, Marion, Multnomah, Washington, and Yamhill counties in Oregon. This study area is consistent with the socioeconomic study area identified in the Application for Site Certification.[1]

  The study area for potential environmental justice impacts from the proposed Facility includes Census Tracts (CTs) within 0.5 mile of the proposed Facility. CTs are small subdivisions of counties that were created by the US Census Bureau. They are designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions. A county is divided into CTs, which usually has between 1,000 and 8,000 residents (US Census Bureau 2014a).

- **The rail corridor study area**. Consists of the counties within 0.5 mile on either side of the rail corridor from the Washington-Idaho border to the Port of Vancouver and includes both Washington and Oregon counties located within 0.25 mile of the Columbia River shoreline from Pasco/Kennewick to Vancouver, Washington. For areas outside of Washington and Oregon, socioeconomic impacts are discussed qualitatively.

  The environmental justice analysis for the rail corridor provides a more geographically specific study area than each respective county by analyzing the CTs within 0.5 mile of both sides of the rail corridor from the Washington-Idaho border to Vancouver, Washington, and within 0.25 mile of the Columbia River from Kennewick/Pasco to Vancouver, Washington. For areas outside of Washington and Oregon, environmental justice impacts are discussed qualitatively.

- **The vessel corridor study area.** Consists of the counties through which Project-related vessel transportation would occur, including Clark, Cowlitz, Pacific, and Wahkiakum counties in Washington; and Clatsop, Columbia, and Multnomah counties in Oregon.

  The environmental justice analysis for vessel transportation provides a more geographically specific study area than each respective county by analyzing the CTs within 0.25 mile of both shorelines of the Columbia River from Vancouver, Washington, to the Pacific Ocean.

Information sources used in the socioeconomics analysis include data published by a variety of local, state, and federal sources such as the 2000 Census, the 2010 Census, American Community Survey (ACS), Bureau of Economic Analysis, Bureau of Labor Statistics, Oregon Employment Department, and

1 WAC 463-60-535 specifies that the socioeconomic study area for the EFSEC application should include the area that may be affected by employment within a 1-hour commute of the project site.

Washington Office of Financial Management. Data are presented for the study area counties, Washington and Oregon, subject to availability.

3.16.1.1 Housing

To determine potential effects to housing, the estimated number of construction and operation workers requiring housing for the proposed Facility was considered within the context of available housing within a 1-hour drive of the proposed Facility. Specific worker needs, by occupation were considered within the context of the total number of workers by occupation within the Portland-Vancouver Metropolitan Statistical Area (MSA) to determine if workers currently residing within the study area could be sourced from within the proposed Facility study area.

3.16.1.2 Employment and Income

The analysis of employment and income effects is based on employment, income, and other Facility-related spending data compiled by the Applicant (Appendix O [Schatzki and Strombom 2014a]). Schatzki and Strombom used employment, income, and Facility-related spending in an IMpact analysis for PLANning (IMPLAN) model to estimate direct and related economic effects (Appendix O). IMPLAN captures both the direct impacts of new economic activity as well as subsequent impacts of construction and operation of a project on the regional economy.

3.16.1.3 Tax Revenue

Taxes generated by the proposed Facility include several forms of payments to state and local governments including sales tax, business and occupation (B&O) tax, property taxes, and other taxes such as payments for temporary disability insurance and business license fees. Tax revenue attributable to the proposed Facility was calculated using information from multiple sources, including the Washington Department of Revenue, Oregon Department of Revenue, and Applicant-provided information in BergerABAM (2014), and *Assessment of Vancouver Energy Socioeconomic Impacts: Primary Economic Impacts* (Appendix O).

3.16.1.4 Property Values

Schatzki and Strombom (2014b) conducted a literature review of relevant studies using the hedonic approach to determine property value effects (Appendix O). Within the field of economics, the hedonic method has been widely applied to property valuation scenarios to measure property value effects of amenities such as proximity to open space or parks and property value diminution from negative externalities such as noise and contamination. Schatzki and Strombom (2014b) identified two hedonic studies that provide incremental rail traffic effects on property value: *Examining the Spatial Distribution of Externalities: Freight Rail Track and Home Values in Los Angeles* (Futch 2011) and *The Effect of Freight Railroad Tracks and Train Activity on Residential Property Values* (Simons and El Jaouhari 2004). The findings from Schatzki and Strombom (2014b) used in this analysis are based upon the research conducted by Futch (2011) and Simons and El Jaouhari (2004).

3.16.1.5 Rail and Vessel Traffic

The analysis of socioeconomic impacts from rail and vessel traffic associated with the proposed Facility considers the costs of congestion and delays to businesses in the study areas. The incremental increase in rail and vessel traffic is assessed within the context of existing traffic volumes to provide an indication of magnitude. This analysis relied on data from the *Washington State Rail Plan: Integrated Freight and Passenger Rail Plan 2013–2035* (WSDOT 2014), *Vessel Entry and Transit Counts* (Ecology 2015), and Applicant-provided information in *Vessel Traffic Risk Assessment Traffic Impact Analysis*

(WorleyParsons 2014). Three costs associated with delayed trains are considered: train operating cost, shipper freight car costs, and shipper inventory costs. Train operating cost includes the cost of fuel, equipment ownership, and locomotive maintenance. Shipper (customer) freight costs are considered within the context of delay cost because many railcars in freight rail service are owned or leased by rail customers and train delays reduce the utilization of these cars, forcing shippers to lease more railcars than required under efficient operation. Furthermore, inventory in transit has a cost, as it is often financed or represents postponed profits. Train delays extend the time in transit and the cost of this inventory.

Based on numerous rail studies (The I-5 Transportation and Trade Partnership 2003, Texas Department of Transportation 2007, Greater Buffalo-Niagara Regional Transportation Council 2010), the average costs of carrier and shipper cost per train hour of delay was estimated to be $409.07 (2014 dollars), which should be considered a conservative estimate, because within the context of ‘just in time’ management practices, train delays could affect shipper logistics, scheduling, and productivity.

Costs of train delays for at-grade crossings were estimated by analyzing the value of lost time from traffic delays.[2] The analysis used the *Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis* (DOT 2011), rail crossing data obtained from the FRA (2015), and Applicant-provided information (Schatzki and Strombom 2014b).

3.16.1.6 Environmental Justice (Minority and Low-Income Populations)

Information on race, ethnicity, income levels, and poverty rates within the study areas was used to determine if disproportionate effects[3] of the proposed Facility and associated rail and vessel transportation of crude oil would occur to minority or low-income populations. The analysis used methodologies established by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (*59 FR 7629, 1994) and guidance published by both the President’s Council for Environmental Quality (CEQ 1997) and the EPA (1998a, b).

In accordance with the CEQ guidance, minority populations should be identified if the minority population in the vicinity of a project exceeds 50 percent or is meaningfully greater than the “minority population percentage in the general population or other appropriate unit of geographic analysis.” Both CEQ and EPA (1998a, b) have not defined any percentage of the population that can be characterized as “meaningfully greater.” In accordance with recommendations provided by *The National Guidance for Conducting Environmental Justice Analysis* (EPA 1998b) the meaningfully greater criterion for minority populations was assumed to be equal to or greater than 120 percent (1.2 times) the statewide reference population. Similarly, recommendations provided by EPA (1998b) were used to determine if meaningfully greater concentrations of low-income populations were present within study area CTs. The low-income criterion is defined as below 2 times the poverty threshold (EPA 1998b). Low-income populations were identified using the US Census Bureau’s (2013a) ratio of income to poverty level.

Environmental justice impacts could occur in the event that a CT population meets or exceeds 120 percent of the statewide concentration of minority population, or if the proportion of the CT population below 2 times the poverty threshold exceeds the statewide concentration of individuals below two times the

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2 The value of personal time is assumed to equal $12.50 per hour for drivers in cars, while the value of time for business travel is $22.90 for cars and $24.70 for trucks (2009 dollars). See Appendix N, Table N-11 for additional detail.

3 A disproportionate effect is an incidence (or prevalence) of an effect, a risk of an effect, or likely exposure to environmental hazards potentially causing such adverse health effects on a minority and or low-income population, or subpopulation, that significantly exceeds that experienced by a comparable reference population.

poverty rate. Where major impacts are identified in these areas (e.g., safety concerns, noise, air, and aesthetic impacts), disproportionate impacts are assumed to occur.

3.16.2 Affected Environment

3.16.2.1 Proposed Facility

Population

According to data from the US Census Bureau, the population of the proposed Facility study area grew by nearly 884,000 between 1990 and 2012 to approximately 2.7 million (see Appendix N, Table N-1), representing an increase of 47.7 percent over the period (US Census Bureau 1990; US Census Bureau 2014a). Clark County, Washington; Multnomah County, Oregon; and Washington County, Oregon, have the largest populations of residents and, in 2012, the population within these three counties accounted for a combined 63.8 percent of the population within this study area. In addition to accounting for a large proportion of this study area population, both Clark County, Washington, and Washington County, Oregon, exhibited the largest gains in population over the 1990–2012 period, with a population growth of 83.9 and 75.7 percent, respectively. Neighboring counties experienced varying levels of absolute population growth between 1990 and 2012. Skamania County, Washington, and Hood River, Oregon, both saw relatively limited population gains of 2,900 and 5,700 people, respectively.

As provided in Appendix N, Table N-2, the total population within the proposed Facility study area is projected to increase 26.7 percent from 2.7 million in 2012 to 3.5 million by 2030 (Washington Office of Financial Management 2007, Oregon Office of Economic Analysis 2013). Over the 2012–2030 period, county population changes within the proposed Facility study area are projected to range from 16.0 percent decline in Multnomah County, Oregon, to 41.9 percent increase in Cowlitz County, Washington.

Demographics and Low-Income

The race and ethnic mix of the proposed Facility study area population is primarily white, with white residents accounting for 79.5 percent of the total (Appendix N, Table N-3) (US Census Bureau 2013b). African-Americans constituted 2.4 percent of the population, American Indian and Alaska Natives 0.4 percent, two or more races 4.4 percent, and other races 13.2 percent. Asian and Hawaiian and other Pacific Islander accounted for 0.0 percent of the study area population. Residents of Hispanic origin (of all races) accounted for 17.6 percent of this study area population (US Census Bureau 2013b). Approximately 50.3 percent of residents of this study area are below 2 times the poverty threshold established by the US Census Bureau. (US Census Bureau 2013a).

Housing

The proposed Facility study area has approximately 1.1 million housing units and an estimated 70,000 vacant housing units (US Census Bureau 2014b). Vacancy rates for rental housing range from 3.6 to 11.3 percent among the various counties in the study area. Housing data for the proposed Facility, rail corridor, and vessel corridor study areas are summarized in Appendix N, Table N-4.

Unemployment

Unemployment rate within the proposed Facility study area peaked at 10.8 percent in 2009, the same year that unemployment peaked in Oregon at 11.1 percent (Appendix N, Table N-5) (Bureau of Labor Statistics 2014). The lowest unemployment rate of 5.0 percent occurred in 2007.[4]

4 Over the 2003–2013 period.

Employment

The manufacturing sector accounts for the largest share of total jobs in Cowlitz County, Washington (14.4 percent of total); Washington County, Oregon (14.7 percent); and Yamhill County, Oregon (15.3 percent) (Appendix N, Table N-6) (Bureau of Economic Analysis 2014). The government sector accounts for the largest share of countywide employment in Skamania County, Washington (20.8 percent); Columbia County, Oregon (12.3 percent); Marion County, Oregon (19.6 percent); and Multnomah County, Oregon (12.1 percent). The health-care industry is an important employer in each of the study area counties, accounting for the largest share of county employment in Clark County, Washington (13.1 percent), and Hood River County, Oregon (12.1 percent).

Income

Median household income ranged from $46,890 in Marion County, Oregon, to $64,350 in Clackamas County, Oregon (US Census Bureau 2013c). All Washington study area counties had a lower median household income than Washington State's overall median household income. Conversely, nearly all Oregon study area counties exhibited a higher median household income than Oregon State's overall median household income, with the exception of Marion County. Per capita income within the study area ranged from $22,000 in Marion County, Oregon, to $32,780 in Clackamas County, Oregon.

Tax Revenue

Sales and Use Tax

Sales tax is paid for goods and services purchased within Washington, and a use tax is paid when goods and services purchased from outside of the state are used within Washington. Washington's principal source of tax revenue is the 6.5 percent retail sales and use tax, which yielded $7.7 billion in fiscal year 2013 (Washington Department of Revenue 2014). The total sales tax rate in the City of Vancouver is 8.4 percent, of which 6.5 percent goes to the State of Washington and 1.9 percent goes to the local area (Washington Department of Revenue 2015a).

Business and Occupation Tax

Businesses in Washington are subject to the B&O tax, which is levied on the value of products, gross proceeds of sale, or gross income of a business (Washington Department of Revenue 2015b). It is anticipated that construction activities would be classified as 'retailing' as identified by the Washington Department of Revenue and would be subject to the state B&O tax rate of 0.471 percent (Washington Department of Revenue 2015c). The City of Vancouver does not administer a B&O tax.

In Washington, crude oil is charged a B&O tax when it reaches a refinery (Washington Research Council 2010). Since all refineries that could receive crude oil are located at some distance from the proposed Facility and outside of the study area, B&O taxes on crude oil are not included in this analysis.

Property Tax

Real property and personal property are subject to property tax in Washington. Real property includes land and any improvements, such as buildings attached to the land. Personal property are possessions not affixed to the land. Property taxes would be paid on the value of the Facility.

Oregon State Income Tax

The State of Washington does not administer a personal income tax, whereas the State of Oregon does. Oregon would receive income tax revenue from proposed Facility workers that reside in Oregon.

Other Taxes

Other taxes include payments such as temporary disability insurance, business license fees, payments for fines, and donations.

Property Value

The value of property can be measured in several ways. The price at which property is bought and sold under competitive conditions determines the market price. Assessors estimate the value of residential properties based on the recent sale price of nearby, similar properties, while the value of most commercial and industrial properties are based on the potential use or revenue-generating potential of the property. County assessors assess the value of real property for tax-collection purposes.

The US Census Bureau (2015) defines median value of owner-occupied homes as the respondent's estimate of how much their house and lot would sell for if it were for sale. It includes only single-family houses located on less than 10 acres and excludes mobile homes, houses with a business on the property, and housing units in multiunit structures. The median value of owner-occupied homes as reported by the US Census Bureau and the average assessed value of real property and residential property as reported by the States of Washington and Oregon are provided in Appendix N, Table N-8 (Washington Department of Revenue 2013, US Census Bureau 2014b, Oregon Department of Revenue 2015).

The median owner-occupied home value within the proposed Facility study area counties ranged from $181,500 in Cowlitz County, Washington, to $321,700 in Hood River County, Oregon. In 2012, the average assessed value of residential property and real property in the study area was $182,700 and $215,300, respectively.

Environmental Justice

No minority populations exceeded 50 percent of the total CT population in any CT within the proposed Facility study area for environmental justice (Appendix N, Table N-3) (US Census Bureau 2013b).

Two meaningfully greater minority and/or low income population CTs are located within the proposed Facility study area. Meaningfully greater concentrations of residents within the Fruit Valley neighborhood (CT 410.05) in Washington identify themselves as belonging to the other race category, are of Hispanic or Latino ethnicity, and are low-income. A meaningfully greater concentration of two or more races and low-income populations is located within Hayden Island (CT 72.01) in Oregon (US Census Bureau 2013 a, b).

3.16.2.2 Rail Corridor

Population

Population within the rail corridor study area grew by nearly 663,000 between 1990 and 2012 to approximately 2.2 million (Appendix N, Table N-1) (US Census Bureau 1990, 2014a), representing an increase of 43.1 percent over the period. Spokane County, Washington; Clark County, Washington; and Multnomah County, Oregon, have the largest populations of residents when compared to other counties in the rail corridor study area. In 2012, the population within these 3 counties accounted for a combined 76.0 percent of the population within the rail corridor study area. Franklin County, Washington, experienced the highest population growth rate of all counties within the rail corridor study area, exhibiting a 128.9 percent increase in population over the 1990–2012 period. Conversely, Sherman County, Oregon, experienced a decrease in population over this timeframe, with county population falling by nearly 200 people between 1990 and 2012. Neighboring counties within the rail corridor study area experienced varying levels of absolute population growth between 1990 and 2012. Gilliam County, Oregon, and Lincoln County, Washington, both experienced relatively limited population increases of 231 and 1,591 people, respectively.

As provided in Appendix N, Table N-2, population within the rail corridor study area is projected to increase by 21.6 percent from 2.2 million in 2012 to 2.7 million by 2030 (Washington Office of Financial Management 2007, Oregon Office of Economic Analysis 2013). Over the 2012–2030 period, population changes within rail corridor study area counties are projected to range from -0.5 percent growth in Sherman County, Oregon, to 32.7 percent growth in Hood River County, Oregon.

Demographics and Low-Income Populations

The race and ethnic mix of the rail corridor study area population is primarily white, with white residents accounting for 83.3 percent of the total (Appendix N, Table N-9) (US Census Bureau 2013b). African-Americans constitute 1.5 percent of the population, American Indian and Alaska Natives 1.5 percent, Asian 2.3 percent, Hawaiian and other Pacific Islander 0.2 percent, other race 7.8 percent, and two or more races 3.4 percent of this study area population. Residents of Hispanic origin (of all races) accounted for 18.0 percent of the population in this study area. Approximately 38.5 percent of rail corridor study area residents are below 2 times the poverty threshold established by the US Census Bureau (US Census Bureau 2013a).

Housing

The rail corridor study area has approximately 898,000 housing units and an estimated 63,000 vacant housing units (US Census Bureau 2014b). Vacancy rates for rental housing range from 1.7 percent in Franklin County, Washington, to 11.3 percent in Skamania County, Washington.

Unemployment

Unemployment within the rail corridor peaked at 10.4 percent in 2010, the same year that unemployment peaked in Washington at 9.9 percent (Bureau of Labor Statistics 2014). The rail corridor study area experienced the lowest unemployment rate of 5.1 percent in 2007.[5]

Employment

Employment by industry within the rail corridor is summarized in Appendix N, Table N-10 (Bureau of Economic Analysis 2014). The government sector is the major employer in 8 of the rail corridor counties, ranging from 12.1 percent of total employment in Multnomah County, Oregon, to 26.4 percent of total employment in Lincoln County, Washington. The agriculture sector takes a prominent role within many of the rail corridor counties, with 7 counties having more than 10 percent of total employment classified as farm employment. Farm employment in Gilliam County (14.8 percent) and Sherman County (18.2 percent) in Oregon accounts for the greatest proportion of total jobs within these counties. In general, the health-care industry is an important employer in most of the study area counties, with the sector accounting for the largest share of county employment in Clark County, Washington (13.1 percent); Spokane County, Washington (15.5 percent); Hood River County, Oregon (12.1 percent); and Wasco County, Oregon (17.1 percent).

Income

Within the rail corridor study area, median household income ranges from $41,690 in Klickitat County, Washington, to $60,485 in Benton County, Washington (Appendix N, Table N-7) (US Census Bureau 2013c). Nearly all study area counties located in Washington each have lower median household income than Washington's overall median household income, with the exception of Benton County. Hood River and Multnomah counties, Oregon, exhibit higher median household income than the statewide median household income for Oregon. Per capita income in rail corridor counties is lowest in Franklin County, Washington ($19,500) and highest in Multnomah County, Oregon ($30,480).

Tax Revenue

No tax revenue would be collected for the rail corridor study area.

5 Over the 2003–2013 period.

Property Value

The median owner-occupied home value within rail corridor study area counties ranged from $116,400 in Gilliam County, Oregon, to $321,700 in Hood River County, Oregon (US Census Bureau 2014b). In 2012, the average assessed value of residential property and real property in the rail corridor study area was $162,700 and $184,000, respectively (Appendix N, Table N-8) (Washington Department of Revenue 2013, Oregon Department of Revenue 2015).

Environmental Justice

Five areas within Franklin County, Washington, have Hispanic or Latino populations exceeding the 50 percent criterion (Appendix N, Table N-9) (US Census Bureau 2013b). These areas include areas of Pasco (CT 201, CT 202, CT 203, and CT 204) and the Connell/Mesa area (CT 208) of Franklin County.

Of the 96 CTs located within the rail corridor study area, 79 have meaningfully greater concentrations of minority or low-income populations.[6] Nine CTs within the rail corridor study area have meaningfully greater concentrations of African American populations, 24 CTs have meaningfully greater concentrations of American Indian and Alaska Native populations, 4 CTs have meaningfully greater concentrations of Asian populations, 11 CTs have meaningfully greater concentrations of Hawaiian or Other Pacific Islander populations, 25 CTs have meaningfully greater concentrations of other race populations, 24 CTs have meaningfully greater concentrations of two or more race populations, 23 CTs have meaningfully greater concentrations of Hispanic or Latino populations, and 61 CTs have meaningfully greater concentrations of low-income populations (US Census Bureau 2013a, b).

Rail Traffic and Crossings

The 2010 daily track capacity for Columbia River Alignment segments is provided in Table 3.14-7 (in Section 3.14) and shows daily track capacities of between 37 and 76 percent (WSDOT 2014). An estimated 200 at-grade crossings are located within the rail corridor study area.

3.16.2.3 Vessel Corridor

Population

Population within the vessel corridor study area grew by nearly 413,000 between 1990 and 2012 to approximately 1.4 million (Appendix N, Table N-1), representing an increase of 41.3 percent over the period (US Census Bureau 1990, 2014c). Multnomah County, Oregon, and Clark County, Washington, have the largest populations of residents when compared to other counties in this study area. In 2012, the population within these 2 counties accounted for a combined 85.0 percent of the population within the vessel corridor study area. Clark County, Washington, experienced the highest population growth rate of those counties within the vessel corridor study area, exhibiting an 83.9 percent increase in population over the 1990–2012 period. Neighboring counties within the vessel corridor study area experienced varying levels of absolute population growth between 1990 and 2012. Wahkiakum and Pacific counties, Washington, both experienced relatively limited population increases of 670 and 1,709 people, respectively.

Population within the vessel corridor study area is projected to increase by 23.0 percent from 1.4 million in 2012 to 1.7 million by 2030 (Appendix N, Table N-2) (Washington Office of Financial Management 2007, Oregon Office of Economic Analysis 2013). Over the 2012–2030 period, population changes within the counties in the vessel corridor are projected to range from 7.3 percent growth in Clatsop County, Oregon, to 41.9 percent growth in Cowlitz County, Washington.

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6 Franklin County, CT 9801 has been excluded since demographic information from the 2008-2012 ACS is not available for this CT.

Demographics and Low-Income Populations

The race and ethnic mix of the vessel corridor study area population is primarily white, with white residents accounting for 91.0 percent of the total (Appendix N, Table N-12) (US Census Bureau 2013b). African-Americans constitute 0.8 percent of the population, American Indian and Alaska Natives 1.6 percent, Asian 1.3 percent, Hawaiian and other Pacific Islander 0.1 percent, other race 2.0 percent, and two or more races 3.2 percent of the study area population. Residents of Hispanic origin (of all races) accounted for 7.2 percent of the study area population. Approximately 34.3 percent of study area residents are below 2 times the poverty threshold established by the US Census Bureau (US Census Bureau 2013a).

Housing

The vessel corridor study area has approximately 600,000 housing units and an estimated 46,200 vacant housing units (US Census Bureau 2014b). Vacancy rates for rental housing range from 2.1 percent in Wahkiakum County, Washington, to 9.8 percent in Clatsop County, Oregon.

Unemployment

Unemployment within the vessel corridor was 11.5 percent in both 2009 and 2010 (Bureau of Labor Statistics 2014). The vessel corridor study area experienced the lowest unemployment rate in 2007[7] (Appendix N, Table N-5).

Employment

The government sector accounts for the largest share of total employment in Pacific County, Washington (19.9 percent); in Multnomah County, Oregon (12.1 percent); and in Columbia County, Oregon (12.3 percent) (Appendix N, Table N-13) (Bureau of Economic Analysis 2014). The health-care industry accounts for the largest proportion of county employment in Clark County, Washington (13.1 percent). The largest number of jobs within Cowlitz County, Washington, is in the manufacturing sector with 14.4 percent of total jobs within the county. Approximately 16.7 percent of total jobs in Clatsop County, Oregon, are in the accommodations and food service industry, while nearly 16.5 percent of total jobs in Wahkiakum County, Washington, are in the forestry and fishing industry (Appendix N, Table N-13).

Income

Median household income within the vessel corridor ranges from $39,830 in Pacific County, Washington, to $58,230 in Clark County, Washington (Appendix N, Table N-8) (US Census Bureau 2013c). All study area counties located in Washington have lower median household income than the Washington statewide median household income. Clatsop and Multnomah counties, Oregon, exhibit higher median household income than the Oregon statewide median household income. Per capita income in vessel corridor counties is lowest in Wahkiakum County, Washington ($22,330), and highest in Multnomah County, Oregon ($30,480).

Tax Revenue

No tax revenue would be collected for the vessel corridor study area.

Property Value

The median owner-occupied home value within vessel corridor study area counties ranged from $162,000 in Gilliam County, Oregon, to $271,600 in Hood River County, Oregon (US Census Bureau 2014b). In 2012, the average assessed value of residential property and real property in the vessel corridor study area was $167,900 and $190,900, respectively (Washington Department of Revenue 2013, Oregon Department of Revenue 2015).

7 Over the 2003–2013 period.

Environmental Justice

No minority populations exceeded 50 percent of the total CT population in any CT within the vessel corridor study area (Appendix N, Table N-12) (US Census Bureau 2013b).

Of the 27 CTs located within the vessel corridor study area, 20 exceed the meaningfully greater criteria for the presence of minority or low-income populations.[8] Two CTs within the rail corridor study area have meaningfully greater concentrations of African American populations, 7 CTs have meaningfully greater concentrations of American Indian and Alaska Native populations, 1 CT has meaningfully greater concentrations of Asian populations, 3 CTs have meaningfully greater concentrations of Hawaiian or Other Pacific Islander populations, 4 CTs have meaningfully greater concentrations of Other Race populations, 7 CTs have meaningfully greater concentrations of Two or More Race populations, 5 CTs have meaningfully greater concentrations of Hispanic or Latino populations, and 15 CTs have meaningfully greater concentrations of low-income populations (Appendix N, Table N-9) (US Census Bureau 2013a, b).

Vessel Traffic

Commercial vessel calls have declined by 31.0 percent on the Columbia River from 1993 to 2013. In 1993, a total of 2,113 commercial vessel calls were made on the Lower Columbia River and in 2013, a total of 1,457 commercial vessel calls were made (Ecology 2015). For deep-draft vessels, 164 deep-draft transits were recorded by Ecology in 2013 (Ecology 2014).

3.16.3 Impact Assessment

3.16.3.1 Proposed Facility

Construction

Employment and Income

The Project is anticipated to support 239 direct onsite and offsite full-time jobs during the Phase I construction period, which is projected to last for a period of 12 months (Appendix O, Table 1).[9] Phase II construction is expected to last for a period of 6 months and support approximately 81 direct onsite and offsite jobs. Combined, both Phase I and Phase II are expected to support a total of 320 direct jobs over the entire construction period (Appendix N, Table N-14). These 320 direct onsite and offsite employees are expected to earn $31.4 million of income. In total, when including both indirect and induced benefits, Facility construction is projected to support a total of 1,429 full-time jobs, with associated income of $86.8 million (Appendix O).

Housing

A total of 239 direct full-time onsite and offsite jobs are expected to be supported during Phase I of Facility construction. Despite this number, it is anticipated the Project will require 407 part-time employees to fill the majority of these full-time positions. Therefore, when including permitting and engineering employment, it is estimated the Project will directly support a total of 442 full-time and part-time workers during Phase I construction (Appendix O). Phase II is expected to occur over a shorter

8 Clatsop County, CT 9900 has been excluded, because demographic information from the 2008-2012 ACS is not available for this CT.

9 Direct off-site construction and operations employment is derived from the IMPLAN model and relies on the estimated operating expenditures provided to the Analysis Group by the Applicant (see Appendix O, Section III). For instance, operating expenditure estimates were assigned to various IMPLAN sector categories including but not limited to, natural gas, water and sewer, and legal services. Once assigned to the appropriate IMPLAN sector, the IMPLAN model was ran to determine the off-site direct employment effects for each sector for which it was anticipated the Applicant would purchase goods and services.

timeframe and employ fewer workers than Phase I and some Phase I employees may also work on Phase II construction.

The Portland-Vancouver MSA is likely capable of supplying most, if not all, of experienced labor necessary for Project construction (Appendix N, Table N-16). Some workers may need to move or travel to the vicinity of the proposed Facility to fill some specific occupations, such as steel workers necessary during construction. Despite this need, it is expected that most employees would come from the study area and housing impacts would, therefore, be negligible.

Tax Revenue

The total tax revenue associated with construction of the proposed Facility is expected to be $22.5 million, which would be a one-time source of state and local revenue (Appendix N, Table N-17).

Sales and Use Tax

The total cost of construction for Phase I and Phase II is estimated to be $210 million. By applying the Washington sales tax rate of 6.5 percent, and the local sales tax rate of 1.9 percent to the total cost of construction, it is anticipated that Facility construction would generate $13.7 million in retail sales tax revenue for the State of Washington and $4.0 million in revenue for local taxing authorities.

Business and Occupation Tax

The B&O tax is levied on the gross receipts of business operations. No deductions are made for labor, materials, taxes, or other cost of doing business (Davis 2008). If a contractor is hired to perform a construction contract, the contractor is taxable on the total value of the construction contract. Further, gross receipts from prime contracting on a custom construction job, like the proposed Facility, are taxable under the Retailing B&O tax classification (Davis 2008). Therefore, by applying Washington's Retailing B&O classification rate (0.00471) (Washington Department of Revenue 2015c) to the total construction cost of $210 million, it is estimated that B&O taxes from construction activities would total nearly $1.0 million.

Property Tax

Property taxes for the proposed Facility are expected to be $2.3 million annually (Appendix O). It is also expected that local property tax revenue would be generated due to expanding business activity from supporting businesses. Based on IMPLAN output, additional property taxes from indirect and induced business activity are expected to be approximately $2.6 million during construction (Appendix O).

Income Tax

Only those workers that reside in Oregon would be subject to the Oregon income tax. It is assumed that the residency of proposed Facility construction workers would be similar to existing Port of Vancouver workers. Research conducted for the Port determined that 19.6 percent of Port workers are Oregon residents (Port of Vancouver 2011). Therefore, this analysis assumes that 19.6 percent of Facility construction workers would also be Oregon residents. It is therefore estimated that the State of Oregon would receive approximately $362,100 in income tax revenue from construction if the proposed Facility (Appendix N, Table N-18).

Other Taxes

Additional tax revenue would be generated during construction of the proposed Facility such as payments for temporary disability insurance, business license fees, payments for fines, and donations. Based upon the IMPLAN analysis conducted for the Applicant (Appendix O), Project construction would generate approximately $0.9 million in other one-time taxes and fees to state and local government.

Rail and Vessel Traffic

As provided in Section 3.14.3.1, the construction of the proposed Facility and rail infrastructure is expected to result in only minor impacts to rail transportation, with no associated economic impacts likely to occur.

Barges and other construction-related vessels may contribute to congestion along a portion of the river adjacent to the proposed Facility. However, this congestion would be temporary and is not anticipated to economically impact other vessel operators in the area.

Environmental Justice

Impacts to minority and low-income populations from construction of the proposed Facility could include exposure to hazardous materials, changes to air quality, noise, and visual effects, and disruption to traffic patterns.

As provided in Section 3.8.3.1, releases affecting public health are not anticipated during construction because of the limited types and relatively small quantities of hazardous materials that would be used during construction, and because the public would be prevented from accessing the site. Furthermore, air quality emissions are not anticipated to create more than minor air quality impacts in areas close to the proposed Facility site (see Section 3.2.3.1). Therefore, no environmental health or air quality impacts are anticipated for environmental justice populations within the environmental justice study area.

As provided in Section 3.9.3.1, construction-related impacts from pile driving would have a negligible noise impact and slightly perceptible ground vibration on some residents near the proposed Facility including the Fruit Valley neighborhood (CT 410.05) environmental justice population.

During construction, temporary changes to the visual setting near the proposed Facility would occur from the presence of construction workers, equipment, vehicles, and partially constructed structures, and storing materials and equipment (Section 3.11.3.1). These minor impacts would not represent a disproportionate effect for environmental justice populations within the proposed Facility study area.

As provided in Section 3.14.3.1, construction of the proposed Facility and rail infrastructure is expected to result in only minor impacts to roadway or rail transportation, so no disproportionate effect on environmental justice communities would occur.

Operation

Employment and Income

According to the Applicant, Facility operations are expected to start up in 2016, at which time operations are estimated to support direct onsite employment of 91 full-time jobs. Annual direct onsite employment at full buildout is projected to be 176 full-time jobs each year over the 2017–2030 timeframe. In addition to these jobs, the estimated direct offsite employment for operations is projected to be 211 full-time jobs during startup (2016) and 440 full-time jobs each year over the 2017–2022 period. The direct onsite and offsite labor income associated with full operation is estimated to be $67 million in 2017, rising annually to $88 million in 2030. Including both indirect and induced impacts with direct (onsite and offsite) impacts, Facility operation at full buildout is projected to support 1,081 jobs annually, with associated total income of $90 million in 2017 and increasing to $118 million by 2030 (Appendix N, Table N-15).

Housing

The Portland-Vancouver MSA is likely capable of supplying most if not all of experienced labor necessary for operation of the proposed Facility (Appendix N, Table N-16). Some workers may need to move or travel to the Facility vicinity to fill some specific occupations, such as rail engineers and switchmen during operation. Despite this need, it is expected that most employees would come from the proposed Facility study area and housing impacts would be negligible.

Tax Revenue

During operations startup, total annual tax revenue is expected to be nearly $5.0 million dollars. Once full buildout is achieved, total annual tax revenue from Project operations is estimated to be approximately $8.2 million.

Sales and Use Tax

Based on results from the IMPLAN model, total sales tax revenues for annual operations is expected to be $1.5 million during operations startup (2016) and approximately $3.2 million annually during the remainder of Project operations (2017–2030) (Appendix O).

Property Tax

Based on IMPLAN output, additional property taxes from indirect and induced business activity are expected to be about $0.8 million in the first year of operation startup and $1.6 million annually during the remainder of Project operation (Appendix O).

Income Tax

It is anticipated that Oregon would receive income tax revenue from Facility workers that reside in Oregon. It is assumed that the residency of Facility operations workers would be similar to existing Port workers (19.6 percent; Port of Vancouver 2011). It is estimated that the State of Oregon would receive approximately $332,900 in income tax revenue annually from operations once fully built out (in 2017) (Appendix N, Table N-18).

Other Taxes

Additional tax revenue would be generated by the proposed Facility such as payments for temporary disability insurance, business license fees, payments for fines, and donations. Based on the IMPLAN analysis, operation of the proposed Facility would generate $0.3 million in other tax revenues the first year of operations startup and $0.7 million annually thereafter (Appendix O).

Rail and Vessel Traffic

As provided in Section 3.14.3.1, the operation of unit trains associated with the proposed Facility would likely result in only minor impacts to rail transportation, with no associated economic impacts. The use of berths for the proposed Facility is not expected to create delays for other river users, with no associated economic impacts likely to occur.

Environmental Justice

As provided in Section 3.8.3.1, releases affecting public health are not anticipated during Facility operation. Air quality impacts would be expected to be negligible to minor from Facility operations, with no associated effects to environmental justice populations.

Facility operation is expected to result in negligible to minor noise impacts at sensitive receivers near the site (Section 3.9.3.1) and would not represent a disproportionate effect upon environmental justice communities in the proposed Facility study area.

Visual impacts from operation and maintenance of the proposed Facility are expected to be minor (Section 3.11.3.1) and would not represent a disproportionate effect on environmental justice communities in the proposed Facility study area.

Impacts to roadways from operation and maintenance traffic are expected to be minor (Section 3.14.3.1), with no associated disproportionate effect on environmental justice populations in the proposed Facility study area.

Decommissioning

Impacts resulting from decommissioning activities are expected to be similar but less than impacts of Facility construction. Employment would be required for decommissioning activities, resulting in income for workers. Employees would likely come from the surrounding area, with no associated housing impacts. Since limited construction materials are anticipated to be purchased (restoration materials), sales tax revenue would be far less than that generated during construction, and other taxes would cease to be paid after the completion of decommissioning and site restoration activities. Traffic impacts from decommissioning vehicles would not likely result in roadway congestion, with no related economic impacts.

The site restoration plan would identify, evaluate, and resolve identified environmental, public health, and safety issues, which would reduce the potential for disproportionate impacts to environmental justice populations.

3.16.3.2 Rail Transportation

Employment and Income

Within the rail corridor study area, potential exists for increased employment associated with increased rail transportation associated with the proposed Facility. Increased demand for rail could require that existing rail workers increase productivity or motivate railroad companies to hire additional workers to accommodate the increased rail demand. Based on 2010 IMPLAN data for rail services in the United States, for every additional $1 million in rail industry sales, approximately 2.6 jobs are directly supported. However, it is unknown if these rail jobs would be filled by local residents. Rail operations associated with the proposed Facility could therefore have beneficial impacts to employment generally, but not necessarily within the rail corridor study area. Impacts for the rail corridor study area outside of Washington and Oregon would be similar to those inside of Washington and Oregon because increased demand for rail services could lead to increased employment and income, but this employment would not necessarily occur within the local area.

Housing

Rail operations associated with the proposed Facility could have beneficial impacts to rail employment. However, these potential job benefits would not necessarily occur within the study area. Furthermore, rail employees may increase their productivity to accommodate for this additional rail demand. Therefore, given these factors, demand for housing in the rail corridor study area as a result of rail transportation associated with the proposed Facility is expected to be negligible. Similarly, housing impacts for the rail corridor study area outside of Washington and Oregon would be negligible because employment benefits would not necessarily occur within this area.

Tax Revenue

According to the Applicant, the incremental increase of four unit trains per day traveling along the rail route could reduce property value within a mile of the rail corridor by 0 to 1.5 percent, which could reduce property tax collections for homes located within a mile of the rail corridor by a corresponding 0 to 1.5 percent. Property tax impacts for the rail corridor study area outside of Washington and Oregon are also anticipated to be in the 0 to 1.5 percent range (Appendix O).

Property Value

The Applicant has estimated the incremental increase of 4 additional trains per day could reduce property value within a mile of the rail corridor by not greater than 1.5 percent (Appendix N, Tables L-19 and L-20), which is considered to be a minor impact. Reduction in property value within the rail corridor study area outside of Washington and Oregon is similarly anticipated to be no greater than 1.5 percent (Appendix O).

Rail Congestion

As provided in Section 3.14.3.2, the addition of rail traffic associated with the proposed Facility would cause some segments of rail lines to approach or exceed capacity with some shipments experiencing delays. It is estimated that rail carriers and shippers would conservatively experience a combined $409.07 for each hour of train delay time accrued. This same impact is anticipated for each hour of train delay time accrued within the rail corridor study area outside of Washington and Oregon.

Rail Crossing Delays

The rail corridor study area includes a total of 200 at-grade crossings, of which historical average annual daily traffic estimates are available for 113 of these crossings through the DOT. Using an approach similar to the approach used by Schatzki and Strombom (2014b), supplemented with additional at-grade crossing information, it is estimated that the total annualized personal and business costs associated with four additional daily inbound trains from Idaho to Vancouver would be approximately $220,660[10] (Appendix N, Table N-21). Vehicle delays are expected within the rail corridor study area outside of Washington and Oregon due to Project-related rail traffic. However, the magnitude of this impact has not been quantified and would depend on the number of crossings and the number of vehicles present when a train passes (Section 3.14.3.2).

Environmental Justice

Property value within a mile of the rail corridor is expected to decrease by 0 to 1.5 percent, which would not constitute a disproportionate effect to minority or low-income communities. Additional rail traffic generated by the proposed Project is not expected to increase the rate of potential accidents and fatalities for pedestrian trespass or motorists (Section 3.8.3.2), would cause a less than significant increase in air emissions due to rail delays and minor air quality impacts from train operations (Section 3.2.3.2), would have minor noise impacts (Section 3.9.3.2), and would not represent a disproportionate effect upon environmental justice communities in the proposed Project vicinity. No disproportionate effects on environmental justice communities along the rail corridor would occur from these minor impacts. However, rail transportation would increase gate downtime delay by between 15 and 26 percent along the rail route, which could result in moderate to major impacts to motorists and the ability of emergency responders to respond to an accident in a timely manner. The increased gate downtime resulting from unit trains associated with the proposed Facility could, therefore, have disproportionate effects on environmental justice populations in communities along the rail corridor study area.

Impacts for the rail corridor study area outside of Washington and Oregon would be similar to those inside of Washington and Oregon for property value, air quality, noise, and visual resources as Project-related rail traffic is anticipated to have negligible or minor impacts to these resources. Even so, the magnitude of rail delay impacts upon disadvantaged populations in the rail corridor outside of Washington and Oregon has not been quantified.

10 This estimate of rail crossing delay cost is conservative given that average annual daily traffic estimates are not available for 87 crossings within the rail corridor study area.

3.16.3.3 Vessel Transportation

Employment and Income

Increased demand for marine services could spur pilotage and tug companies to hire additional workers to accommodate increased vessel demands. Research conducted for the Applicant by WorleyParsons (2014) found that the existing number of pilots are sufficient to handle increased vessel demands associated with the proposed Facility (Appendix N). If additional pilots were required, Columbia River Pilots would increase staffing, which could be done as traffic demands increase. Furthermore, Shaver Transportation Company indicated that the projected traffic increase could be absorbed into the fleet it currently maintains. Therefore, it is anticipated that employment and income effects for the vessel corridor would be negligible to minor.

Housing

The increase in vessel traffic associated with the proposed Facility is not anticipated to require additional employment, with no related housing impacts.

Government Revenue

The State of Oregon would likely receive some additional tax revenue to due to an increase in Oregon-based pilot and tug operator revenue, as well as additional income taxes associated with these companies' employees.

Property Value

Visual and noise impacts from vessels associated with the proposed Facility would result in negligible to minor impacts along the vessel corridor study area, with no associated property value effects.

Vessel Traffic

It is anticipated that the forecasted increase in vessel traffic is well within the capacity of the Lower Columbia River and that new vessel traffic would not cause delays (Section 3.14.3.3), with no associated economic impacts.

Environmental Justice

Public health and safety impacts associated with vessels transiting to and from the proposed Facility are expected to be minor. Furthermore, emissions from vessels are anticipated to be minor (Section 3.2.3.3), noise from transiting vessels is anticipated to be minor (Section 3.9.3.3), and vessels would create minor visual impacts to residents along the vessel corridor study area. No disproportionate effects on environmental justice communities along the vessel corridor would occur from these minor impacts.

3.16.4 No Action Alternative

Under the No Action Alternative, the governor would deny the Applicant's request to construct and operate the proposed Project at the Port, and the following impacts to socioeconomics from two scenarios could occur:

- **No development.** In the event that no development occurred at the Port, current monitoring and maintenance would continue and no beneficial or adverse impacts would occur to socioeconomics.
- **A different industrial facility.** Commodities could include grain, sand and gravel, lumber, metal, or petroleum products. Socioeconomic impacts from construction and operation of such a facility are likely to be similar to the proposed Facility. The construction and operation of another facility would likely increase employment, income, tax revenue, and perhaps a slight demand for area housing, and could have implications for environmental justice populations in the study area.

However, the type and magnitude of these impacts would ultimately depend on the type of facility developed at the site.

3.16.5 Mitigation Measures

The design features and BMPs proposed by the Applicant to avoid or minimize environmental impacts during construction, operations and maintenance, and decommissioning are assumed to be part of the Proposed Action and have been taken into account during the analysis of environmental impacts to socioeconomic resources in this Draft EIS. EFSEC has identified the following additional mitigation measures for the Applicant to implement to reduce impacts to socioeconomic resources:

- Coordinate with BNSF to schedule shipments to reduce congestion and delays for other trains using the Spokane to Pasco segment of the Columbia River Alignment to the extent possible.
- Coordinate with BNSF to schedule rail shipments to avoid travel through populated areas during peak traffic times to the extent possible to reduce unequable burden to environmental justice populations.

3.16.6 Significant Unavoidable Adverse Impacts

The addition of rail traffic associated with the proposed Facility would cause some segments of rail lines to approach or exceed capacity, with some shipments experiencing delays, costing rail carriers and shippers a combined $409.07 for each hour of train delay time accrued.

Trains traveling to the proposed Facility would increase gate downtime delay at all roadway-railroad at-grade crossings. This delay is anticipated to create costs for personal and business travelers, which can be translated into an annualized economic cost of approximately $220,660.

It is expected that increased gate downtimes as a result of train traffic associated with the proposed Facility would have moderate to major impacts for some minority and/or low-income populations within the rail corridor study area by creating an inequitable burden from motorist delays and delays in response times for emergency responders.

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